GCA ENVIRONMENTAL SERVICES

QUALIFICATIONS TO PROVIDE HAZARDOUS WASTE ENFORCEMENT SUPPORT

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September 1981

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SECTION I

INTRODUCTION AND APPROACH

A. INTRODUCTION

In providing technical support to the Office of Waste Program Enforcement (OWPE), work performed will involve the completion of specific task orders on a quick-response basis. The demands placed on a contractor by a contract of this type are severe, but such contracts have been the main stay of GCA/Technology Division's business over a decade as a prime contractor to the U.S. EPA. Successful performance requires:

- Reputation as a Quick Response EPA Enforcement Contractor--GCA is recognized by the Division of Stationary Source Enforcement (DSSE) as one of their most respected and requested contractors having conducted or initiated 130 quick response tasks for Headquarters and the Regional Offices over the last 4 years. For DSSE, GCA has conducted more toxic related programs than most other contractors. In addition, GCA has conducted hazardous waste enforcement projects for other Enforcement Divisions by providing expert witnesses and technical support to the Hazardous Waste Task Force and EPA Region V, and by developing toxic-related enforcement guidelines for the toxic enforcement program.

- Experienced Personnel--The contractor must have available a large and versatile staff experienced in hazardous waste site characterization, remedial engineering, cost evaluation and enforcement case development support expertise.

- Sound Management--In a contract of this type, many task orders will run simultaneously. All programs must be closely monitored to ensure the availability of facilities and personnel and compliance with time and cost schedules. In addition, the program manager and his selected principal investigators must possess unique and proven team and project management skills, and be capable of maintaining effective Agency/Contractor communications while closely coordinating and monitoring the project personnel, facilities, budget and schedule.

- Adequate Facilities--In a contract of this type, the broad spectrum of field activities requires the Contractor to possess the physical facilities adequate to respond to program needs ranging from a broad-coverage computerized literature search capability, through the development of specialized field sampling equipment and apparatus and sophisticated laboratory analyses capabilities.

GCA's rapid response capabilities are exemplified by over 300 separate task assignments conducted by GCA over the last 3 years, under a variety of LOE and task order contracts. Nearly half of these have been conducted in support of EPA headquarters and regional office enforcement support projects.

The experience of our personnel spans the areas of data gathering, site inspections, in-field investigations, sampling and analysis, and evaluation of remedial action alternatives. To accomplish these activities, our staff of 250 includes geologists; hydrologists; civil, sanitary, chemical and process engineers; computer science; economists; environmental and health science and other scientific and engineering disciplines. In addition, GCA has used a variety of subcontractors at dump sites and takes full responsibility for the execution of their work, as we have at Love Canal.

Table I-1 summarizes the academic qualifications of GCA's technical staff in accordance with the disciplines required for this program. The totals are not reflective of the aggregate professional population of our organization because many staff members have academic training in more than one discipline or other disciplines not specified for application on this program. GCA's technical staff population numbers approximately 175, most of whom do, however, meet the requirements of the envisioned work. Resumes of key GCA staff appear in Section IV which provides detailed information on background and experience.

From this group, technical teams will be formed which will best meet the needs of specific work assignments. We recognize that the success of this program will depend heavily on effective program and project management. Of particular importance is the requirement that the Program Manager be experienced and adept at: managing a multidisciplinary staff; solving logistical problems (scheduling technical staff and equipment); dealing

effectively and convincingly with State and Federal Agencies, industrial work groups and representatives; and working effectively with subcontractors and consultants.

TABLE I-1. SUMMARY OF GCA/TECHNOLOGY DIVISION TECHNICAL STAFF BY DISCIPLINE

Senior Project Director	15	Accountant	4
Environmental Engineer	14	Estimator	6
Ecologist	16	Mechnical Engineer	6
Geologist	3	Meteorologist	5
Soils Engineer	6	Physicist	2
Hydrogeologist	3	Technician	6
Civil Engineer	4	Draftsman	3
Toxicologist	7	Economist	5
Doctor of Medicine	0[a]	Hydrologist	3
Biologist	6	Attorney	3
Chemist	25	Chemical Engineer	19

[a]Consultants only

The GCA/Technology Division main facility is located in Bedford, Massachusetts. This 71,000 square foot facility houses the chemistry, physics, engineering and aerosol measurements laboratories; the field testing support facility; the instrument production facility; the library; the technical publications department; and the business-administration offices. For additional field measurement support, GCA also maintains a 1,500 square foot test site at its Bedford location. In addition, GCA maintains a 5,000 square foot office building at its Chapel Hill, NC facility.

Support will be carried out by selected members of all five Departments of GCA/Technology Division located in Bedford, Massachusetts. The relationship of these Departments to the overall organization of the Division is shown in Figure I-1.

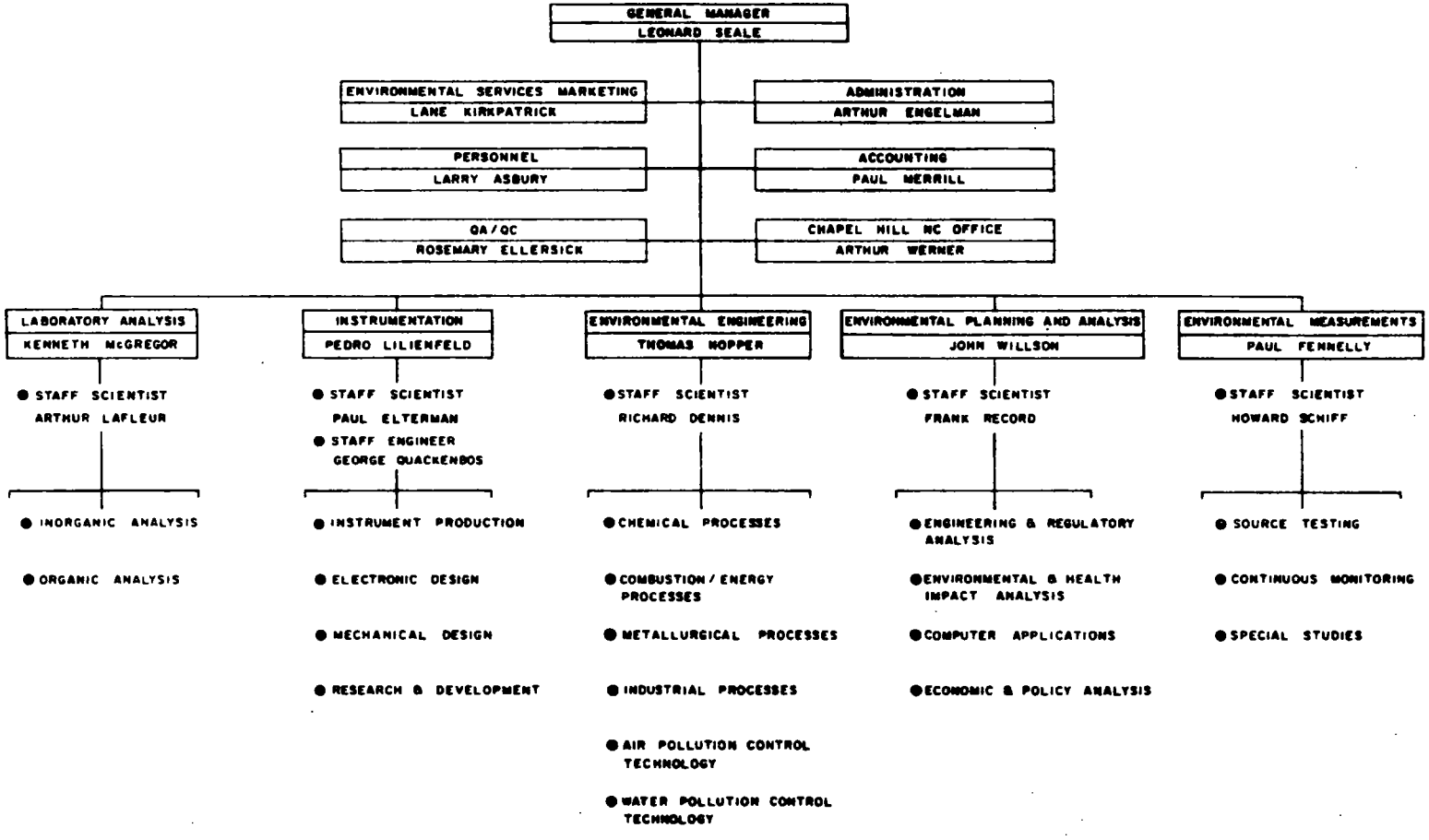

Figure I-1. Technical Support for Region V Enforcement Activities--Organization Chart, GCA/Technology Division.

The GCA/Technology Division routinely utilizes computer processing of data in support of contract work in a wide range of technical areas. The computer facilities used by GCA personnel include: IBM 370/158 (2 units); UNIVAC 1108; CDC 6600; and Honeywell 6050. An increasing share of these data provessing activities has been concerned with the design and implementation of environmental data systems including use and/or installation of enforcement related data systems such as SAROAD, NEDS, CDS, MCDM and RAM formats, and the EIS/P&R and AQDHS-II systems. GCA's data processing activities have encompassed: installation of systems; training and assistance to states; retrieval, sorting and reporting of data; design of retrieval and data management systems; and interface of such data systems to health and environmental effects monitoring, enforcement, new source review, emissions density zoning, environmental assessment, and state implementation planning programs.

Detailed information covering GCA's facilities, equipment and instrumentation holdings is contained in Section III, including those of our analytical laboratory and field measurement departments.

B. APPROACH

Specifically, hazardous waste work assignments are expected to be issued which require field investigations, technical cost analysis, expert testimony, reports, statistical computations, economic analysis and public presentations relating to enforcement cases.

This section has been developed to demonstrate our understanding of the requirements of this area and to describe our general approach to the conduct of Work Assignments that may be issued thereunder. When a specific assignment is issued by OWPE, GCA will respond with a detailed, specific Work Plan describing the technical approach by subtasks, the scheduling and milestones for completing each subtask, and cost data.

1. Case Support, Expert Witness Testimony

The provision of legal and technical assistance to OWPE relative to enforcement litigation requires that the contractor possess a diversity of skills. GCA is well qualified having demonstrated over the past several years an exceptional ability to effectively respond to Agency needs in areas of hazardous waste and wastewater characterization and control, site inspections and evaluations, report reviews, and data collection and evaluation. GCA has staff personnel who have worked for local, State and Federal air pollution control agencies in roles with major enforcement responsibilities. We are, therefore, sensitive to the types of public presentations and other forms of enforcement technical support that is required of EPA contractors.

a. Hazardous Waste/Wastewater Characterization and Control--Characterizing the chemical composition and quantity of wastes will be accomplished by several techniques depending on the Scope of the particular Work Assignment. Order-of-magnitude estimates can be made by reviewing the specific process or waste-generating operation and relying on process engineering estimates based on material balances. A more accurate characterization can be made based on a detailed engineering inspection of the facility, a thorough review of process and control device data, and comparison with similar facilities that have accurate effluent data. One of the most precise techniques for characterizing wastes is, of course, a field sampling program taking into account all waste streams. The specific approach to be taken by GCA will be determined by discussion with the Project Officer and documented in the Work Plan for each Work Assignment.

b. Site Inspections--The first step in conducting a site inspection is sometimes termed "offsite reconnaissance" which consists of quickly assembling and reviewing all available background information prior to visiting the site. The scope and extent of background information will vary with the project complexity, and the amount of time available to research the information. For example, in the case of a hazardous material spill from a

railcar derailment, little office time should be spent and the site should be inspected immediately. The offsite reconnaissance will normally involve a file review at EPA Headquarters or at other appropriate regulatory agencies, the site owners office, and possibly the office of the hazardous waste generator and transporter. The type of collected information includes: applicable laws and regulations; status of litigation, if any; Regional Office strategy; permit and compliance schedules; past reports and data; waste types and quantities; disposal/storage methods; geology/hydrogeology of area; history of prior incidents; site ownership structure; and maps of the area.

After background data has been reviewed, an inspection strategy is developed and reviewed in-house and with the EPA Project Officer. The site inspection should provide the information necessary for GCA/EPA to properly assess the situation, and in many cases, the site inspection data will be sufficient for enforcement actions or emergency remedial action. The type of field data normally collected at a site inspection includes the following:

- Determination of the need for emergency response;
- Determination of disposal practices and methods;
- Compliance with Federal, state and local regulations;
- Determination of the extent of contamination;
- Amounts and locations of hazardous waste stored;
- Potential for materials to migrate offsite;
- Determination of access control;
- Documentation or determination of imminent hazards;
- Remedies to bring site into compliance;
- Review of site records;
- Inventory of drums or drum contents;
- Mapping the site;
- Safety procedures for field investigation;

- Determination of potential sampling sites for field investigation;
- Sample collection during inspection.

c. Report Reviews--Work Assignments may also require the contractor to review reports prepared by other consulting organizations, EPA, or industry. First, an upper management staff member selects a review committee composed of senior level engineers or scientists with backgrounds in the report subject matter. The report is then carefully scrutinized, the report calculations and assumptions carefully checked, and the data presentation and report conclusions then compared to the raw data and basic assumptions. If it bcomes necessary to clarify report contents, the report authors or sponsoring organization will be contacted. The report review will conclude with either a verbal or written critique, dependin on the requirements of the specific assignment.

d. Data Collection--Similarly, GCA staff professionals are adept at developing, collecting, organizing, evaluating, and disseminating data relative to environmental control problems. Our staff includes chemical and environmental engineers, statisticians, computer specialists, economists, and engineering aides who routinely collect and evaluate data relative to pollutant composition and discharge rates, industrial process operations, pollutant control devices, and hazardous waste quantities and their fate. Our approach to data collection and evaluation is custom tailored to each particular task. We rely heavily on the technical literature, our own site inspections or sampling data, EPA file data, contact with industry, academic or EPA experts, and our extensive in-house expertise. The data evaluation step can range from a cursory overview of the information to an indepth scrutiny of the data origin with complete verification of the data source, methods used to compile the information, validity or representativeness of the data relative to similar types of information, and collection of additional data to support the existing data base.

2. Information Collection and Evaluation

Work Assignments under this area will require quick-response development of technical and economic information to determine the effectiveness and social/economic impacts of resolving enforcement case problems. For assignments involving industrial process wastes, the contractor may be required to evaluate installed, alternate, and proposed techniques for pollution control at specific industrial plants. GCA's approach to such a technical and economic evaluation will involve in-house knowledge, survey of current technical literature, and contact with equipment vendors and plants that may be using the technology being evaluated.

3. Public Presentation/Expert Witness Testimony

Work Assignments in this Program Area may require the provision of expert testimony, technical assistance or information files in support of enforcement proceedings in an administrative or judicial forum. Early in the enforcement process the contractor may have to participate in technical review and enforcement planning meetings with EPA, State and local enforcement officials, and source owners and operators. The contractor may have to: present or review detaled process and effluent data; act as a technical expert by commenting on the data's veracity, the need for additional data, and the process conditions under which such effluent data is to be obtained; and provide technical and administrative assistance to EPA during public and judicial deliberations.

An enforcement case may proceed to a State or local variance or arbitration board or to an EPA enforcement staff hearing for the purpose of negotiating an enforcement order. In this case, the contractor must discuss his technical findings in prehearing meetings with the appropriate EPA staff. The contractor must work closely with the appropriate attorneys and consider the manner and style of his presentation in any legal proceeding.

As a case proceeds to the courtroom, the situation becomes more formal. The contractor must remember that any previous statements he has made at administrative hearings may now be a matter of record; therefore, he must

be careful not to introduce an element of contradiction for any statement made within the enforcement proceedings. The contractor must also be careful not to bear testimony on subjects outside his area of expertise lest he lose his credibility as an expert witness. In a court hearing, an expert witness must present a confident yet reasonable composure. This requires a thorough understanding of the technical area, the position to be taken on the stand, anticipating questions and responses, and delivering as smooth and concise a presentation as possible.

Public presentations may also be required at professional meetings, workshops, and seminars. This could include the presentation of results or studies to the environmental community or participation in work groups, study committees or panel discussions. The Contractor's involvement in these professional forums is an important element of EPA's public participation programs.

SECTION II

EXPERIENCE

GCA's hazardous waste and enforcement experience includes the conduct of site surveys, extensive environmental characterizations, regulatory assistance, research and development projects, provision of expert witnesses and subcontractual support for hazardous waste enforcement cases. Table II-1 summarizes GCA's experience in these areas.

Although GCA/Technology Division has the in-house expertise to conduct almost all aspects of programs in the hazardous waste area, we have enlisted the services of two firms--Goldberg, Zoino Associates, Inc. and Residuals Management Technology--to provide support on a subcontractural basis.

Below are abstracts of selected technical projects conducted by GCA and its subcontractors, which relate most directly to supporting OWPE.

- Love Canal Monitoring Program

  GCA was the prime contractor for the U.S. EPA in a $5.4 million integrated monitoring effort at Love Canal, Niagara Falls, New York. The area in the vicinity of love Canal was declared a Federal Emergency Area, and the EPA was designated to conduct an environmental monitoring program at Love Canal to determine the levels of pollution in soil, water, and air. As prime contractor, GCA managed the overall program, including subcontractor efforts, and delivered to EPA appropriate data for evalaution to determine the extent of the risk caused by substances found during monitoring. This monitoring project is probably the most extensive project of this type ever conducted in the United States.

  The program resulted in: the collection and analysis of over 3000 samples from soils, streams, impoundments, drinking water, sewers, basement sumps, and biological species; approximately 2600 air samplers and; drilling of 178 wells. The EPA offices in Research Triangle Park, NC, Ada, OK, Cincinnati, OH, and Las Vegas, NV and Washington, D.C. worked with GCA in coordinating the overall effort.

  The services of 20 subcontractors were used to complete the work and to provide overall program and data management and QA/QC coordination.

TABLE II-1. SUMMARY OF GCA/TECHNOLOGY DIVISION EXPERIENCE RELATED TO HAZARDOUS WASTE ENFORCEMENT

Project title	Contract No.	Contract funding	Contracting organization	Project officer	GCA project manager	Title
Love Canal Integrated Monitoring Program	EPA-68-02-3168 Task 26	$5,400,000	U.S. EPA	Tom Hauser	Robert Bradway	Program Manager
Technical Support for Region V (Chicago) Hazardous Waste Enforcement Activities	EPA-68-01-6421	$ 418,000	U.S. EPA	Norm Nedergang	Tom Hopper	Department Manager
Preliminary Remedial Investigation for the Pollution Abatement Services, Inc. (PAS) Site Oswego, NY	EPA-68-02-3168 Task 48	$ 90,000	U.S. EPA	Ken Stoller	Robert Bradway	Program Manager
Survey of Selected State Capability to Perform Tasks Mandated by Superfund	EPA-68-02-3168 Task 27	$ 59,000	U.S. EPA	Gerald Emison	John Willson	Department Manager
Preliminary Remedial Investigation for the Kin Buc Landfill, Edison, NJ	EPA-68-02-3168 Task 49	$ 91,000	U.S. EPA	Ken Stoller	Robert Bradway	Program Manager
Sampling and Analysis of Industrial Hazardous Waste Streams Relative to Section 3001 RCRA	EPA-68-02-3168 Task 47	$ 500,000	U.S. EPA	Dave Oestreich	Tom Hopper	Department Manager
Hazardous Waste Enforcement Case Support	EPA-68-01-4143	$ 10,000	U.S. EPA	Frank Biros	David Cogley	Section Manager
Chemical Control Options, Technology and Process Analysis	EPA-68-01-5960	$ 554,654	U.S. EPA	Albert Colli	Fred Seufert	Staff Engineer
Exposure Levels Resulting from the Mining, Milling, Manufacturing and Use of Asbestos	EPA-68-02-2607 Task 26	$ 100,000	U.S. EPA	Richard Guimond	Charles Spooner	Group Scientist
Illinois Industrial Waste Survey	IEPA Contract No. FL_42	$ 150,000	Illinois EPA	Lawrence Eastep	Paul Fennelly	Section Manager
Inventory and Toxicity Prioritization of Industrial Facilities Discharging into the Chesapeake Bay Basin	EPA-68-02-2607 Task 30	$ 43,989	U.S. EPA	Donald Francisco	Thomas Hopper	Section Manager
The Generation and Disposal of Hazardous Wastes in Massachusetts	Massachusetts No. 2-035-01	$ 36,000	State of Mass.	Hans Bonn	Steve Chansky	Senior Engineer
Waste Oil Recovery and Reuse in Massachusetts - An Updated Evaluation	Massachusetts No. 2-041-01	$ 20,000	State of Mass.	Hans Bonn	Paul Fennelly	Section Manager
Waste Oil Recovery and Reuse Program - Residue Management - GCA/Technology Division	Maryland No. 2-033	$ 32,745	State of Maryland	--	Norman Surprenant	Department Manager
Acid Sludge Disposal from Waste Oil Treatment	Maryland No. 75-05-01	$ 17,170	State of Maryland	--	Jim Sahagian	Engineer
Reuse of Waste Oil as Blended Fuel	EPA-68-01-1859	$ 15,000	U.S. EPA	John Jaksah	Stephen Chansky	Senior Engineer

(continued)

TABLE II-1 (continued).

Project title	Contract No.	Contract funding	Contracting organization	Project officer	GCA project manager	Title
Assessment of Industrial Contamination of Soil and Ground Water	--	$ 18,000	Private Client	Ronald Gabriel	David Cogley	Section Manager
Solid Waste Characterization in Environmental Assessment Leachate Generation Procedures	EPA-68-02-3129	$ 40,000	U.S. EPA	Frank Briden	Dan Bause	Principal Scientist
Generation and Analysis of Leachate Samples	--	$ 5,100	Private Client	--	Dan Bause	Principal Scientist
Technical Assistance to the Regional Offices for Implementation of Vinyl Chloride Regulations	EPA-68-01-4143 Task 3	$ 12,114	U.S. EPA	Richard Biondi	Robert Hall	Principal Engineer
Evaluation of PCB Destruction Efficiency in Industrial Boilers	EPA-68-02-2607 Task 33	$ 48,487	U.S. EPA	David Sanchez	Gary Hunt Hunt	Staff Scientist
PCB Compounds Emanating from the New Bedford Municipal Sewage Sludge Incinerator	EPA-68-01-3154 Task 24	$ 19,394	U.S. EPA	John Feldman	Robert Bradway	Department Manager
Quantitative Testing for Polychlorinated Biphenyls	EPA-68-01-4143 Task 15	$ 42,832	U.S. EPA	Norval Van Smith	Robert Bradway	Department Manager
Assessment of Arsenical Pesticide Plants to Determine Sources, Levels, and Control Technology of Potential Arsenic Emissions	EPA-68-02-1337 Task 9	$ 4,585	U.S. EPA	M. S. Jones	Mark Bornstein	Senior Engineer
National Inventory of Sources and Emissions of Chromium, Vanadium, Magnesium, Molybdenum, Phosphorus, Silver, and Titanium	EPA-68-02-0601	$ 20,000	U.S. EPA	David Anderson	Steven Chansky	Senior Engineer
Cadmium: Control Strategy Recommendations	EPA-68-02-1337 Task 2	$ 10,410	U.S. EPA	Justice Manning	Dave Lynn	Staff Scientist
Lead Monitoring Program	--	$ 14,635	Private Client	--	Mark McCabe	Staff Scientist
Collection of Samples for Radioassay at Integrated Mills	EPA-68-02-2607 W.A. No. 34	$ 38,417	U.S. EPA	Charles Amato	Peter Spawn	Staff Engineer
Sprayed Asbestos-Containing Materials in Buildings: Guidance Document	EPA-68-02-2607 Task 25	$ 14,794	U.S. EPA	Larry Dorsey	Charles Spooner	Group Scientist
The Generation and Disposal of Hazardous Wastes in Mass.	Massachusetts No. 2-035	$ 35,000	State of Mass.	Hans Bonn	Paul Fennelly	Section Manager
Industrial Waste Survey for the State of Illinois	IEPA 2-050-01	$ 152,000	Illinois EPA	Lawrence Eastep	Paul Fennelly	Section Manager
PCB Compounds Emanating from the New Bedford Municipal Sewage Sludge Incinerator	EPA-68-01-3145 Task 24	$ 19,394	U.S. EPA	John Feldman	Robert Bradway	Department Manager

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TABLE II-1 (continued).

Project title	Contract No.	Contract funding	Contracting organization	Project officer	GCA project manager	Title
Quantitative Testing for Polychlorinated Biphenyls	EPA-68-01-4143 Task 15	$ 42,832	U.S. EPA	Norval Van Sm th	Robert Bradway	Department Manager
National Inventory of Sources and Emissions of Chromium, Vanadium, Magnesium, Molybdenum, Phosphorus, Silver, Titanium	EPA-68-02-0601	$ 20,000	U.S. EPA	David Andersc	Steven Chansky	Senior Engineer
Inventory and Toxicity Prioritization of Industrial Facilities Discharging into the Chesapeake Bay Basin	EPA-68-02-2607	$ 43,989	U.S. EPA	Donald Francisco	Thomas Hopper	Section Manager
Waste Oil Recovery and Reuse Program - Residue Management	Maryland No. 2-033	$ 32,745	State of Maryland	--	Robert Hall	Principal Engineer
Waste Oil Recovery Study for Massachusetts	Massachusetts No. 2-041-01	$ 20,000	State of Mass.	Hanss Bonn	Paul Fennelly	Section Manager
Analysis of Asbestos Sources	EPA-68-02-3168 Task 2	$ 87,919	U.S. EPA	Richard Guimond	David Cogley	Section Manager
Compliance Monitoring of Asbestos NESHAPS Sources	EPA-68-01-4143 Task 70	$ 51,514	U.S. EPA	Bruce Varner	Peter Anderson	Scientist
Exposure Levels Resulting from the Mining, Milling, Manufacturing and Use of Asbestos	EPA-68-02-2607 Task 36	$ 144,575	U.S. EPA	Richard Guimond	David Cogley	Section Manager
Asbestos Substitute Performance Analysis	EPA-68-02-3168 Task 7	$ 94,678	U.S. EPA	Richard Guimond	David Cogley	Section Manager
Bethlehem Mine Corporation, Grace Mine, Emission Identification and Quantification, Region III	EPA-68-01-4143 Tasks 2 and 9	$ 76,269	U.S. EPA	Leland Marshall	Charles Spooner	Group Scientist
Preparation for a Workshop on Substitutes for Asbestos	EPA-68-02-3168 Task 17	$ 6,202	U.S. EPA	Richard Guimond	David Cogley	Section Manager
Identifying Members of the Asbestos Industry	EPA-68-02-3168 Task 8	$ 26,498	U.S. EPA	Richard Guimond	Mary Ann Chillingworth	Senior Scientist
Chemical Control Options, Technology and Process Analysis	EPA-68-01-5960	$ 554,654	U.S. EPA	Albert Colli	Fred Seufert	Staff Engineer
QA/QC Analysis: Central Regional Laboratory (Region V)	EPA-68-02-3168 Task 14	$ 17,082	U.S. EPA	David Sanchez	Paul Fennelly	Section Manager
Analyses of 21 Soil, Sediment and Leachate Samples from Memphis Area	EPA-68-02-3168 Task 29	$ 20,580	U.S. EPA	Michael Carter	Gary Hunt	Section Manager
Assessment of Industrial Contamination of Soil and Ground Water	--	$ 18,000	Private Client	--	David Cogley	Section Manager

(continued)

TABLE II-1 (continued).

Project title	Contract No.	Contract funding	Contracting organization	Project officer	GCA project manager	Title
Quantitative Testing for Polychlorinated Biphenyls	EPA-68-01-4143 Task 15	$ 42,832	U.S. EPA	Norval Van Smith	Robert Bradway	Department Manager
Sampling and Analysis of Inorganic Materials in Process Streams	EPA_68-02-3129	$1,100,000	U.S. EPA	Frank Briden	Kenneth M Gregor	Department Manager
Radionuclide Analyses of Samples from Georgetown AFBC Support of ORP	EPA-68-02-2693	$ 8,000	U.S. EPA	John Milliken	Paul Fennelly	Section Manager
Heavy Metal and Material Balance of a Fluidized-Bed Incinerator	EPA-68-01-4143 Task 83	$ 45,730	U.S. EPA	Morris Trichon	Robert Bradway	Department Manager
Environmental Assessment/Systems Analysis of Fluidized-Bed Combustion	EPA-68-02-2693	$3,839,808	U.S. EPA	John Milliken	Paul Fennelly	Section Manager
Generation and Analysis of Four (4) Leachate Samples	--	$ 5,100	Private Client	--	Kenneth McGregor	Department Manager
Priority Pollutant Analyses on Liquid Streams from Georgetown AFBC in Support of OWPS	EPA-68-02-2693 Task 7	$ 20,000	U.S. EPA	John Milliken	Paul Fennelly	Section Manager
Environmental Assessment of Conventional Combustion Systems	--	$1,400,000	Private Client	--	Norman Surprenant	Department Manager
Toxic Pollutant Evaluation of Ground Water	--	$ 18,100	Town of Concord, Mass.	Ronald Gabriel	David Cogley	Section Manager
Control Technology Assessment for Benzidine-Based Dye	EPA-68-01-5960 Task 2	$ 18,929	U.S. EPA	Albert Colli	Fred Seufert	Staff Engineer
Control Technology Assessment of Arsenic	EPA-68-01-5960 Task 4	$ 26,998	U.S. EPA	Albert Colli	Robert Hall	Principal Engineer
Control Technology Assessment of 2,4-Diaminotoluene	EPA-68-01-5960 Task 3	$ 30,503	U.S. EPA	Albert Colli	Douglas Carlson	Principal Engineer
Formaldehyde Control Options Analyses	EPA-68-01-5960 Task 10	$ 24,850	U.S. EPA	Albert Colli	Fred Seufert	Staff Engineer
Vermiculite Technical Control Options Analysis	EPA-68-01-5960 Task 9	$ 25,084	U.S. EPA	Albert Colli	Fred Seufert	Staff Engineer
Revision of Incinerator Air Pollution Control Code for State of New Jersey	EPA-68-02-3168 Task 16	$ 95,761	U.S. EPA	Morris Trichon	Paul Fennelly	Section Manager
An Evaluation of Control Needs for the Nitrogen Fertilizer Industry	EPA-68-02-2607 Task 12	$ 30,691	U.S. EPA	Ronald Venesis	Norman Surprenant	Department Manager

TABLE II-1 (continued).

Project title	Contract No.	Contract funding	Contracting organization	Project officer	GCA project manager	Title
Industrial Waste Management Alternatives Assessment for the State of Illinois	--	$ 122,475	Illinois EPA	Myron Landes	Mary Ann Chillingworth	Senior Scientist
Fluidized-Bed Combustion Environmental Assessment	EPA-68-02-2693	$3,839,808	U.S. EPA	John Milliken	Paul Fennelly	Section Manager
Multimedia Comparison of Direct Liquifaction of Coal with Conventional Petroleum Refining	EPA-68-02-3168 Task 13	$ 60,253	U.S. EPA	Samuel Rakes	Arthur Werner	Office Manager

- Preliminary Remedial Investigation for the Kin-Buc Landfill, Edison, NJ

Ten years ago, the Kin Buc Landfill operation in Edison, NJ, began, and for 5 years, industrial process wastes and chemical and municipal liquid and solid wastes were disposed of at this site. Operation was suspended in 1976 when the New Jersey Department of Environmental Protection revoked the site's operating permit for violating environmental statutes. The owner then capped the landfill with a synthetic membrane covered by clay, but in 1979 evidence indicated that ground water contamination was occurring--a sheen assumed to be leachate originating from a depression near the base of the landfill was observed in nearby Edmund's Creek. The owner has refused to take corrective action and denies responsibility for the depression, now known as Pool C.

Federal emergency cleanup activities have already been started to control losses of Pool C leachate into Edmund's creek using adsorbent booms and by pumping collected leachate into drums stored onsite. In addition, a study is underway to determine ownership of the site, and ground water studies have been started to establish whether the pollutants being collected and contained are originating from the Kin Buc Landfill and are migrating to surface waters.

GCA/Technology Division has now begun the next phase of these activities, working to define the Kin Buc leachate volume and chemical composition, as well as the perimeter of the contaminated ground water, and to establish cleanup objectives under three tasks:

- Task 1--Search and Evaluation of Available Information

- Task 2--Hydrogeological Evaluation of the Site

- Task 3--Establishment of Cleanup Objectives

In Task 1, GCA is obtaining relevant information, cataloging it, and evaluating it to determine its precision and accuracy by assessing sampling protocols, chemical analysis protocols, and quality assurance. When the quality of the data is established, the data are entered into GCA's computer-based data management system. Two types of files have been created: a chemical analysis file and a hydrogeology data file. Chemical analysis data are being analyzed statistically to be presented in summary tables, and aquifer test data, water level elevation data, and certain chemical analysis data are being displayed in computer-generated plots. These data are also being evaluated to determine whether they can be used in the hydrogeological modeling that is being performed as a part of Task 2.

In this second task, GCA is modeling the regional and local hydrogeology using aquifer characteristics (hydraulic conductivity, transmissivity, anisotrophy, and storage coefficient), water table

elevation data, and chemical analysis data. Site geology data are also being used to define the boundary conditions. The model, calibrated with historical data predicts contaminant flow direction and rate with and without various remedial measures.

Based on the results of Tasks 1 and 2, GCA will then develop cleanup objectives based on the following considerations:

- Migration of contaminants from the landfill must be stopped.
- Existing offsite contamination must be cleaned up.
- Ideal target values for concentrations of chemical contaminants in the environment must be established.
- Target values based on cleanup method cost realities and schedules must then be determined.

GCA's cleanup objectives will thus consider the extent of pollution now present, the mechanism producing offsite migration of contaminants, potential future levels of contamination, health and environmental impacts, and the economic realities that must be confronted before cleanup can be started.

At the heart of this and similar projects is GCA'c comprehensive quality assurance program, which was developed--along with the health and safety plan, which was designed to protect the GCA investigative team, other investigators, and the general public--based on GCA's experience answering the needs of the Love Canal Integrated Monitoring Program. This project thus incorporates the procedures of this rigorous QA plan to ensure complete, precise, accurate and representative data considering project needs, budget constraints, and schedules.

- Preliminary Remedial Investigation for the Pollution Abatement Services, Inc. (PAS) Site Oswego, NY

The PAS disposal site, located immediately east of Oswego, NY was the site of a high-temperature incinerator, used for liquid waste disposal, that operated from 1970 to 1977. During peak operation, the disposal company received about one million gallons of waste chemicals per month from a variety of chemical companieswithin a four-state region. Now located here are 14,000 drums, 4 above-ground tanks, 3 in-ground tanks, and buried barrels. These tanks and drums have deteriorated and are now leaking, saturating the ground and subsurface soil with waste chemicals to a depth of 14 feet. EPA has hired GCA to perform a preliminary remedial investigation of the site to determine the hydrogeology of the site and to characterize the chemical wastes before disposal operations begin.

This project has also been divided into three tasks:

- Task 1--Search and Evaluation of Available Information

- Task 2--Development of a Specific Work Plan for Updating the Existing Hydrogeological Investigation of the Site

- Task 3--Characterization of Waste Chemicals

The objectives of Task 1 are identical to those of Task 1 of the Kin-Buc project, and as in the Kin-Buc Project, chemical analysis data, aquifer test data, and water level data are being cataloged and evaluated for accuracy and usefulness to the objectives outlined in Task 2.

In Task 2, GCA is performing a hydrogeological evaluation to determine the magnitude and direction of pollution migration. After evaluating all existing geologic data and ground water sampling results, GCA will be developing a work plan that will outline further phases of effort to complete the hydrogeological study of the site, including the adjacent landfill site. This work plan will encompass the following objectives:

- Determine soil contamination.

- Ascertain water table depth.

- Determine direction and rate of ground water flow.

- Determine perimeter of ground water contamination.

- Ascertain concentration of contaminants in ground water.

- Determine surface water and stream sediment contamintion.

- Sample wells of area residents.

As part of this task, to develop a site-specific work plan, GCA is delineating data to be collected, protocols to be followed, quality assurance measures and health and safety measured to be used, and data management procedures to be followed.

GCA's waste characterization efforts will be conducted primarily onsite to provide an expedient and cost-effective disposal approach. The overall objective of this approach is to combine wastes exhibiting compatible chemical and physical properties before disposal. Some key objectives of thi scheme are listed below:

- Segregate aqueous and nonaqueous phases.

- Determine acidity or alkalinity of aqueous phase.

- Analyze for trace metals--aqueous phase.

- Determine reactivity.

- Determine specific gravity--both phases.

- Assess cyanide content--both phases.

- Determine flammability/combustibility/flashpoint--nonaqueous phase (organic).

- Assess organic carbon content--aqueous phase.

- Assess volatile organic halogen content--nonaqueous phase (organic).

- Assess nonvolatile organic halogen content, e.g., PCBs--organic phase.

- Determine general compound classification--organic phase.

Using the information obtained during this entire project, GCA will then develop short- and long-term remedial solutions to clean up the site and to control further contamination of surface and ground water at this site.

- Engineering and Other Technical Support for Hazardous Waste Programs Enforcement

This 5000 man-hour EPA project was initiated for GCA to perform individual work assignments in the following areas:

- site investigations

  -- preliminary site inspections

  -- hydrogeological survey and sampling

  -- sampling at hazardous waste sites

  -- chemical analysis of samples from hazardous waste sites

  -- such additional investigative techniques as title searches, chain-of-custody tracking, shipping, storage, and delivery, collection of observations, compilation and analysis of collected data, documentation of results and report preparation.

- design, development and evaluation of remedies for hazardous waste sites
- advanced engineering
- exposure assessments
- participation in negotiations
- economic analysis
- regulatory analysis
- an accounting of man-hours, dollars and work performed on a monthly and final basis

Information derived from the project is to be used to assist in development of enforcement actions, and other actions taken by the Office of Waste Programs Enforcement (OWPE).

- Technical Support for Region V (Chicago) Enforcement Activities

GCA is implementing a 10,000 man-hour per year, 3-year contract for EPA Region V to provide enforcement to support in the following areas.

- Determining appropriate permit limitations for air, water, and solid and hazardous waste discharges
- Determining compliance with applicable regulations and permit requirements
- Conducting facility surveys and investigations
- Preparing support data and various evaluations for enforcement case development
- Developing enforcement cases and providing expert witness testimony.

Tasks are being executed under individual Work Assignments issued within the framework of one or more of the following Program Areas.

- Water and Hazardous Materials Enforcement/Compliance Activities
- Air Quality Enforcement/Compliance Activities
- Process Evaluation

- Source Water Quality Sampling and Analysis

- Source Air Quality Sampling and Analysis

So far, the bulk of the work has been to support the hazardous waste enforcement area, and this trend is expected to continue.

- Hazardous Waste Enforcement Case Support

This project supports EPA In the prosecution of hazardous waste enforcement cases. In performing this work, the following tasks were conducted:

- Toxicological Evaluations--Reviewed was information contained in a case development plan, and the toxicity of the identified hazardous substances associated with specific hazardous waste sites. These studies included determining toxicity, carcinogenicity, mutagenicity, and other somatic, physiologic, and genetic effects of the substances.

- Geological and Hydrological Evaluations--Hazardous waste sites are characterized by certain geological and hydrological parameters that affect the nature, degree, and extent of environmental contamination. Prepared were technical and engineering evaluations of site geology, hydrology, topography, soil type, depth to ground water and aquifer, etc.; then assessed were the potential for actual ground water and other water supply pollution, the substances involved, and the basis for conclusions.

- Hazard Evaluations--Evaluated were the potential and actual fires, disasters, and other environmental impacts, including damage to vegetation, fish, and wildlife, of the hazardous substances found onsite.

- Remedial Evaluations--Prepared were remedial evaluations of various hazardous waste sites, including analysis of remedies conducted to date, necessary short-term remedies such as site security, labeling, cessation of activity; required intermediate remedies such as repackaging and drilling monitoring wells; and necessary long-term remedies such as waste removal, site isolation, etc.

- Sampling and Analysis of Industrial Hazardous Waste Streams Relative to Section 3001, RCRA

Solid wastes have been loosely defined as those wastes that are composed of solids, semi-solids (including sludges, gels, and slurries), organic liquids including tars, and water-bearing wastes that are deep-well injected, stored in unlined ponds, or disposed of

by methods other than those conventionally used for wastewater. This definition also includes sludges resulting from wastewater treatment. EPA's Office of Solid Waste (OSW) is coordinating an overall solid waste characterization program, a portion of which is directed towards identifying those processes that generate solid wastes in the chemical industry. This program has been designed to document and substantiate any ultimate decision to add the wastes generated by various industries to the existing list of wastes, published in the November 12, 1980, Federal Register, under Section 3001 of the Resource Conservation and Recovery Act (RCRA).

As part of this program, GCA was recently awarded a $500,000 contract by the EPA to perform engineering analyses, and sampling and analytical work to characterize the solid wastes generated by the dye and pigment industry.

First, GCA will examine various dye manufacturing operations located at five designated facilities in the New Jersey and New York area and will then recommend 10 specific production processes for detailed waste characterization using sampling, analysis, and engineering assessments. Following this preliminary work, GCA will then develop detailed manufacturing process profiles, including process flow sheets and technical and cost information on each plant's present waste handling and disposal practices, and detailed, plant-specific sampling plans with recommendations for points to be sampled and sampling procedures to be used.

In the next part of the project, while observing the rigorous quality assurance procedures to be developed in compliance with EPA's requirements, GCA will conduct laboratory analyses of samples collected from the selected processes at each plant to determine characteristics of hazardous waste. The types of samples to be collected will include:

- waste from individual unit operations/processes;
- co-mingled wastes;
- waste sludges or skimmings relating to wastewater treatment;
- any waste that is deep-well injected, ocean-barged, or stored in unlined ponds;
- any off-specification product that cannot be salvaged; and
- any still bottoms, waste filter-cakes, or expended waste catalyst.

Finally, GCA will integrate the information obtained from each process sampled into a comprehensive report containing process

descriptions along with information on waste characteristics and final dispostion, detailed cost information, and any available information to support recommendations that a particular waste be considered hazardous. This information will be instrumental to EPA In the decision-making process to select wastes generated by the dye and pigment industry for possible listing under Section 3001 of RCRA.

- QA/QC Analysis Being Conducted for EPA Region V's Central Regional Laboratory

  GCA is providing quick response support to EPA Region V by performing organic screening of samples submitted by the region. This analytical support enabled Region V not only to assess the degree of contamination in the environmental samples, but also to support improper discharge litigations.

  This task was initiated by the analysis of two standard reference solutions analyzed by Method No. 625 (FR 44: 69540). Most environmental samples were analyzed for the base-neutral faction by combined gas chromotography/mass spectrometry. Polychlorinated biphenyl was analyzed by gas chromatography with electron capture detection.

  The major work elements required to implement this approach are as follows:

  - analysis of standard reference solutions,
  - analysis of environmental samples,
  - data analysis and interpretation,
  - quality control, and
  - quality assurance plan.

- Analysis of 21 Soil, Sediment, and Leachate Samples from Memphis, Tennessee, Area

  Based on our experience gained at Love Canal, GCA was requested by Region IV to analyze hazardous waste samples from the Memphis area. We analyzed soil, sediment, and leachate samples taken from 21 locations for 151 compounds plus the next 20 most concentrated compounds. The samples were analyzed using analytical, safety, and quality assurance/quality control protocols specified in "Proposed Work Plan - Love Canal Monitoring Project,:" Appendix II, August 14, 1980.

- Quick Response Hazardous Organics Assessments Being Provided to Various Clients

  Our Analytical Laboratory is involved in an ongoing effort to assist government and industry in assessing hazardous waste problems. This effort routinely involves analysis for PAH compounds by HPLC/fluorescence detection and capillary GC/MS and analysis for priority pollutants by GC/MS and GC-ECD. Some of the most recent rapid response investigations include analysis of:

  - surface, aqueous, and sediment samples from lagoons at a hazardous waste site in Rhode Island;
  - sediment samples collected from rivers and lakes in the vicinity of wastewater treatment facilities in Vermont;
  - waste oil and waste solvent samples from a hazardous waste disposal site in Massachusetts; and
  - water samples from ponds and lagoons near a chemical plant in Massachusetts.

- Leachate Generation Procedures Evaluated

  GCA is supporting IERL's Process Measurements Branch by identifying a leachate generation procedure suitable for environmental assessment programs. The procedure will help EPA evaluate the ultimate effects of industrial and energy source-related hazardous materials on the environment after placement at a disposal site.

  Currently, emphasis is being placed on energy systems and about 10 types of energy process wastes are being used to evaluate the test procedures in GCA's lab. Both unprocessed and "fixed" waste are being used in this evaluation. In order to determine the reproducibility of the procedures, replicate tests are being analyzed for selected elements by Atomic Absorption Spectrometry. Leachates generated by each procedure will be subjected to analysis using environmental assessment methods to ensure compatibility with the established protocol. Both chemical and biological characterizations are being performed.

  The procedures currently being evaluated by GCA include:

  - the EPA Extraction Procedure (EP),
  - the ASTM Method A (ASTM-A),
  - the ASTM Method B (ASTM-B), and
  - a Carbonic Acid Extraction Method (CAE).

The first three of these procedures are currently being tested by the ASTM via a Round-Robin Analysis Program. Although the IERL evaluation is primarily concerned with environmental assessment requirements, the data generated will also be made available to the ASTM Committee.

- Toxic Pollutant Evaluation of Ground Water Conducted in Concord, MA

  Several sampling and analysis programs were devised to identify and characterize the extent of contamination of the ground water in Concord, Massachusetts. The initial effort was designed to confirm preliminary results that suggested that the ground water in a localized area was contaminated by several priority pollutants. Sampling involved several types of procurement methodologies, and GC/MS was used to scan the samples for purgeable volatile organics. A second effort was initiated to identify the area distribution of several priority pollutants in another area of the town. A monitoring well consisting of a vertical series of Barcad samplers was installed. Sampling through this station and several already existing wells revealed the location and two-dimensional movement of several toxic and hazardous substances, including trichloroethylene.

- Hydrologic and Health Hazard Assessment of a Site in Ashland, MA

  This study was aimed at determining the nature and extent of chemical contamination on the site and the extent to which contaminated surface and ground water may pose a health hazard to neighboring areas. A phased approach to this problem has focused initially on the determination of the actual health hazard represented by the site, with the scope of the second phase--determination of onsite contamination--being dependent on the results of the first phase. The contaminants include both organic chemicals and heavy metals. Ultimate solution of the site problems may include removal of portions of the waste, but for the most part, the intent is to design a site restoration program that will allow most of the sludges and contaminated earth to be treated in place.

- Assessment of Public Water Supply in Acton, MA, that was Contaminated by a Chemical Plant

  The purpose of this study was to define the three-dimenstional distribution and rate of migration of an organic chemical leachate plume toward two public supply wells that were found to be polluted and were closed in 1978. This is a major study of an aquifer nearly 100 feet thick that has been contaminated by about 30 organic chemicals. Because concentrations of chemicals are generally in the parts per billion range, but at levels critical to Federal and State public health decisions, new sampling techniques compatible with quality assurance requirements of EPA's (Region I) Surveillance and Analysis Division Laboratory were developed. A computer flow model

was developed and used during the project to establish ground water and contaminant flow patterns. These data together with GC/MS analyses of more than 80 surface and ground water samples traced contaminants from the town wells to specific source areas up to 3000 feet away. The report also provided a preliminary assessment of methods for renovation and/or restoratin of the aquifer.

This work on the Acton project is continuing on behalf of the U.S. EPA's enforcement division and the U.S. Attorney's Offices. The firm is currently evaluating the constituents in sludges, soils, and ground waters found within and below several chemical waste lagoons, which it identified as major contamination sources. Specific procedures to eliminate these sources will follow as will methods for ultimate dispostion of the ground water contamination.

- Hydrogeologic Study of a Terminal Facility in New Haven, CT

A series of known spills and leaks from solvent and fuel product storage tanks on or near the facility was the suspected cause of nearby seeps, discolorations, and offshore slicks. Inasmuch as the affected area received surface and subsurface flows from numerous other nearby industries, the property owner wished to know how much of the contamination he had produced and/or if other specific sources had contributed to the problem. Responsibility included the siting and inspection of test borings and wells, the performance of in-situ permeability testing, monitoring and water quality sampling, and the analysis of geologic and hydrologic subsurface features. The hydrogeologic analysis, in conjunction with chemical data, obtained during the study, that was used to "fingerprint" the pollutants, was used to identify the likely source of contamination and evaluate the feasibility and efficiency of an interceptor well cleanup system.

- Remedial Trade-Off Evaluation of Five Industrial Dump Sites

An assessment was completed for an industrial client who had used five landfill sites for disposal of hazardous or potentially hazardous wastes, including asbestos and phenolic resins. None of the sites had been owned or operated by the client. The sites were assessed from the following standpoints that could influence the client's liability for any action to clean up the site:

- regulatory framework;
- regulatory compliance--existing or potential enforcement action legal liabilities of site owner vs. users;
- present conditions of site;
- public vs. private ownership;

- site design, operation, monitoring, and closure;
- waste types and quantities disposed at site by client and other site users;
- existing and/or potential environmental threats;
- remedial action already taken; and
- remedial action needed.

Following assessment of each site, specific recommendations were made for further client action in each case. Recommendations ranged from tracking site activity and reviewing regulatory files to full scale in-field conditions studies and waste characterization and analysis of all site users. Finally, several engineering alternatives were developed, and costs to implement each were estimated. The least costly option was to cap the site with clay and then monitor it. The most costly included removing all waste and contaminated soil and transporting it to an acceptable site 250 miles away. Restoration and monitoring of the old site was also included in this alternative. Other options whose costs fell between the extremes included leaving the waste in place at the old site but providing major engineering modifications, such as clay cutoff walls and leachate collection systems.

- Evaluation of Cleanup Alternatives of New Hampshire's Largest Dump Site

This project involved the investigation and cleanup of New Hampshire's largest uncontrolled hazardous waste dump site. Working jointly for the New Hampshire Water Supply and Pollution Control Commission and the U.S. EPA, we were directly involved in cleanup activities which have included identification, excavation, and removal of hazardous and toxic materials; full scale exploration and investigation of subsurface soil and ground water conditions; location, identification, and quantification of contaminated areas and the design of in-ground and above-ground treatment facilities for renovation of the site. This is a particularly complex site where contaminations of many types were disposed, among which were heavy metals, solvents, and other organic compounds. As in several of our other projects, the most recent methodologies were attempted including, in this case, wells to intercept highly contaminated ground water and the use of a large, mobile treatment facility.

- Dump Site in Rhode Island to be Returned to a Useful Purpose

This project was conducted for the Rhode Island Department of Environmental Management and was directed at an uncontrolled hazardous waste disposal site in Burrillville. Here, a large

quantity of hazardous chemicals were disposed into septage pits where they eventually seeped into ground waters, discharged to surface streams, and posed a threat to public and private water supplies. A multidisciplinary team of chemical and environmental engineers, contractors (drillers, surveyors, etc.) were used to supplement geohydrological and geotechnical staff. Work completed to date has included the analysis of the problem, excavation and removal of sludges and chemicals from the septage lagoons, location and interception of the major contaminant plume, and the completion of pilot treatment ground water work that was successful in reducing pollution levels by several orders of magnitude. Costs have been established, final design of the recommended cleanup and restoration scheme is underway, and this should be one of the first such sites in New England to have been restored to useful purposes.

- Regional Solutions to Hazardous Waste Disposal in Illinois Being Developed

The first phase was to inventory all sources of industrial wastewaters and process wastes in the State of Illinois. The results of this survey are geared towards developing a data base for implementation of RCRA and the General Pretreatment Regulations. More than 20,000 industrial establishments were contacted by mail with a followup mailing to nonresponding industries. All survey results were digitized onto computer tape and computer programs and to analyze the data. The final outputs, a series of computer-generated management reports, summarized total waste qualtities, waste types, quantities produced by each industry SIC code, geographyc distribution, disposal method and location, and waste storage. Statistical projections were made to estimate the statewide totals, based on survey results.

The second phase was to chemically and physically characterize the process industrial wastes generated in Illinois, to describe waste management alternatives and technologies, and to assess the feasibility of applying identified technologies or processes to each waste type. The trade-offs, in terms of costs, energy requirements, and environmental impacts, were examined.

- Analysis of Site and Remedial Recommendations for a Dump in Raymond, NH

This project was completed for the New Hampshire Water Supply and Pollution Control Commission and for the EPA's Surveillance and Analysis Division emergency response contractor. An estimated 1500 barrels of hazardous waste were dumped, crushed, and coveree at this locale, and the project was focused on providing complete analysis of the site and recommendations for its restoration. Expansion of the program has led to the immediate implementation of several recommendations including barrel removal and repackaging of waste,

design and construction of surface and ground water diversions, and the handling and disposition of contaminated earth. A followup project was to become involved with ground water restoratin activities at the site.

- Characterization and Disposal of Contaminated Soil on an Abandoned Electroplating Site

  Evidence of contamination was discovered during soil foundation investigations for a proposed 13-story commercial building. GCA investigated the problem using data from a comprehensive coring, trenching and chemical analysis program to define the extent and nature of contamination. Analytical results together with historical data and an analysis of regulatory requirements led to the definition of options for the disposal of soil removed prior to pile driving and foundation work. GCA engineers defined the concentrations, qualities, and ecological impacts of heavy metals present in the soil.

- Solutions Recommended for a Chemical Sludge and Leachate Problem

  Working for Sverdrup and Parcel, prime consultant to the Massachusetts Bay Transportation Authority (MBTA). This project entailed designing and conducting an investigation of chemical sludges and leachates in an industrial area of Cambridge, Massachusetts. Defined were the lateral and vertical limits of strongly acidic contaminants crossing the right-of-way of a proposed MBTA subway tunnel on the basis of pH, conductivity, and index chemical testing. Considering the unique soil and ground water conditions present at this site, certain special construction methods were proposed, designed, and tested, including slurry wall and cut and cover construction techniques. It was also determined that portions of the chemical lagoon and dredged waste materials must be removed prior to construction because of the potentially adverse effects on the subway structure. It is now proposed that the waste solids and liquids be solidified using a silicate fixation process that provides a stable end product meeting EPA leaching criteria. Currently, a testing program is being conducted to determine the suitability of the stabilized material for use as an impermeable cover for local landfill operations. Construction is scheduled for 1981.

- Remedial Recommendations, Engineering, Design and Supervision at Major Industrial Waste Site in Wisconsin

  This site in southeastern Wisconsin is a private industrial waste landfill and one of two licensed hazardous waste sites in Wisconsin. The site receives a wide variety of industrial wastes, including oils, paints, and solvents from the southeastern Wisconsin industrial complex. Complete geotechnical and engineering services

were provided, including an evaluation of in-field conditions and environmental effects of past filling activities, a redesign of the existing landfill area and development of a comprehensive hazardous waste management plan for the facility.

The project involved evaluating several years of water quality monitoring data, monitoring well construction and placement, and ground water flow patterns around the site. Further investigation proposed includes water table monitoring wells, plezometer nests to analyze vertical and horizontal flow gradients, and leachate head monitoring wells. A revised ground and surface water monitoring program will establish background water quality in areas of the site and define the extent and degree of contamination.

Major engineering work performed included base grade design to provide for containment of leachate, sequencing excavations to minimize handling of cover soils, and proper management of hazardous wastes. Transport and treatment of leachate during site operation, and in the post-closure care period, will be included in the redesign of the facility. The next step was to evaluate the suitability of new hazardous wastes proposed for disposal of the site.

An economic analysis that included preparation of new fill areas, daily operating expenses, and closure and post-closure costs ws prepared. This analysis recently resulted in increased disposal fees to account for current and future expenses to comply with newly issued regulations.

Regular liaison has been provided with the U.S. EPA and WDNR. A schedule for preparation of the feasibility and engineering reports required by WDNR is also being developed. The operator of the site is in the process of applying with the U.S. EPA to receive Interim Status.

- Chemical Control Options, Technology and Process Analysis Evaluation for OTS

This 3-year, $1 million quick response task order contract provides EPA-s Office of Toxic Substances (OTS) with technical support in the analysis of chemical control options, assessment of control technologies and analysis of chemical processes. This support is directed toward the responsibility of OTS to promulgate regulations to control the release of toxic substances onto the land and into the air and water. To date, work assignments under this contract have resulted in such investigations for asbestos, benzene, arsenic, benzidene dyes, 2-4 diaminotoluene, 1,2 cichloroethane, acrylamide, vermiculite, and formaldehyde.

- Waste Oil Recovery and Reuse Investigated for Massachusetts

  The purpose of this project was to survey the quantities and types of waste oil in Massachusetts and to investigate the institutional, economic, technical, and environmental barriers that might prevent effective waste oil reuse. More emphasis was placed on rerefining back to lube oil and adverse environmental impacts of combustion as substitute fuel.

- Disposal Options Recommended for Acid Sludge from Waste Oil Treatment

  This program involved laboratory studies and literature reviews to assess various acid sludge disposal options for the State of Maryland. Laboratory tests were performed on raw acid sludge, fluidized sludge, acid-rich washwater, washed fluidized sludge, solids, and oil-rich solvent extract to provide a data base for formulating material and energy balances for various disposal options. Disposal options considered ranged from landfilling to incineration to the manufacture of special byproducts.

SECTION III
FACILITIES

Capabilities in environmental monitoring and analysis, process monitoring instrumentation, and environmental data interpretation are requisite to conduct the proposed program. GCA/Technology Division's staff of 250 possess these capabilities, which are fully supported by facilities located in Bedford, Massachusetts.

The GCA/Technology Division main facility is shown in Figure III-1. This 60,000-square-foot building located in Bedford, Massachusetts, houses the chemistry, physics, and aerosol research laboratories; machine and electronic shops; Instrumentation Department; Analytical Laboratory; Environmental Measurements Department; Technical Library; Technical Publications Department; and the Business Administrative Offices. In addition, 25,000 square feet of space in a neighboring building houses the Environmental Engineering Department and the Environmental Planning and Analysis Department. A separate 1,500-sqare-foot-test facility (fabrication, calibration, and aerosol test laboratory) is also maintained at the main Bedford location.

A. FIELD MEASUREMENTS

1. Monitoring

a. Ambient--GCA/Technology Division has demonstrated a broad capability in ambient monitoring for particulates as well as gaseous pollutants. GCA's pertinent monitoring equipment holdings are listed in Table III-1. The calibration of this instrumentation is conducted in accordance with strict Division QA guidelines and is performed in the ambient laboratory (Figure III-2).

b. Source--The concentrations of fixed gases, NO_x, hydrocarbons, and sulfur species from stationary sources are routinely monitored on a continuous basis. These measurements are made through the use

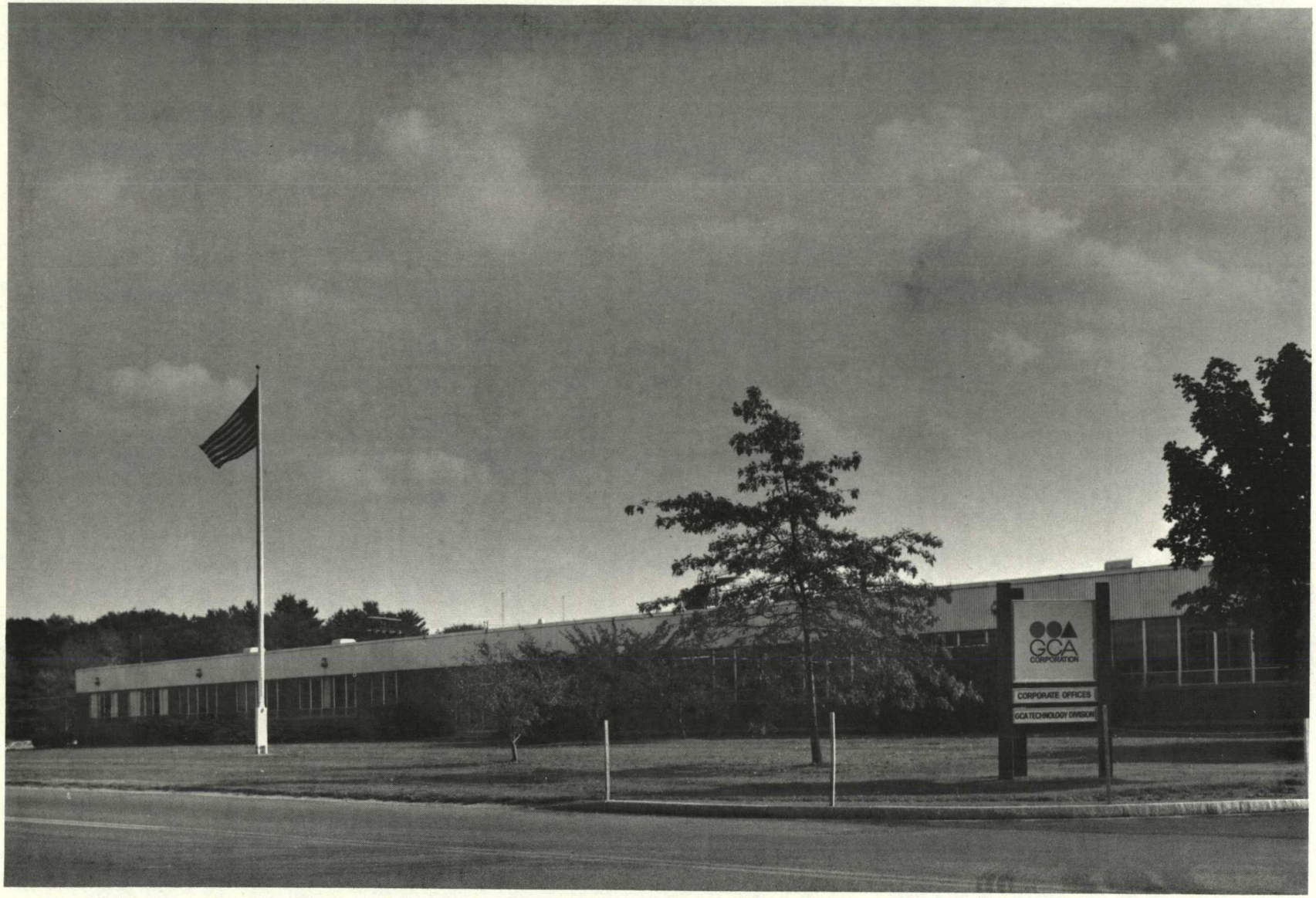


Figure III-1. GCA/Technology Division, Bedford, Massachusetts.

TABLE III-1. GCA/TECHNOLOGY DIVISION AMBIENT AND CONTINUOUS MONITORING EQUIPMENT

Item	Manufacturer	Quantity
Sulfur Dioxide Monitor	Monitor Labs Model 8850	2
Sulfur Dioxide Monitor	Thermo Electron Model 43	3
NO/NO_X Monitor	Monitor Labs Model 8840	2
NO/NO_X Analyzer	Thermo Electron Model 14 DE	2
Carbon Monoxide Monitor	Horiba Instruments	1
Carbon Monoxide Monitor	Ecolyzer	5
Ozone Analyze	Monitor Labs	2
Photometric Ozone Calibrator	Columbia Scientific	1
Dynamic Calibrator	GCA	1
Hydrocarbon Analyzer	Bendix	2
Dichotomous Sampler	Sierra Instruments	2
Recorders	Soltec	3
Permeation tube water bath		1
Instrument shelters	EKTO	3
Recording Respirable Dust Monitor	GCA Model RDM-301	1
Respirable Dust Monitor	GCA Model RDM-101	1
Particle Mass Monitor	GCA Model RDM-201	1
Ambient Particulate Mass Monitor	GCA Model APM	2
Fibrous Aerosol Monitor	GCA FAM	2
Real Time Aerosol Monitor	GCA RAM S	2
Hi-Volume Air Samplers	General Metal Works Model GMWL-2000	12

(continued)

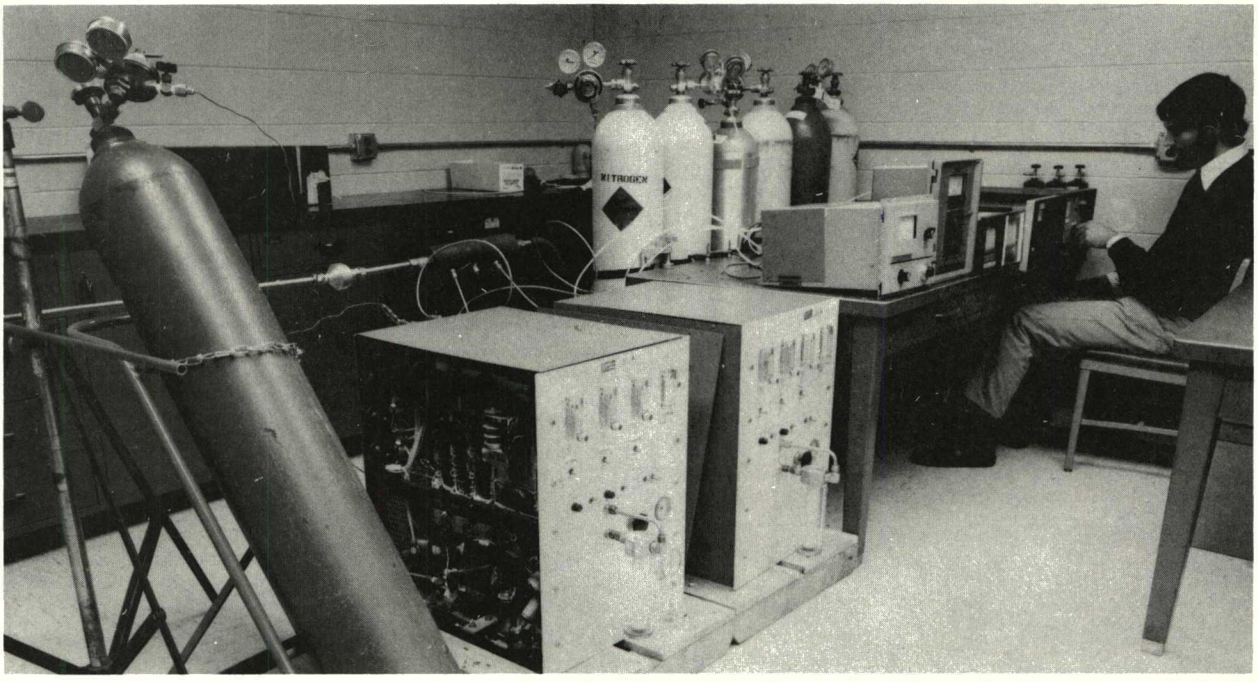
TABLE III-1 (continued)

Item	Manufacturer	Quantity
Portable Calibration System	Monitor Labs Inc. Model 8500	2
Wind Speed and Direction Sensors with Expanded Recorder	Climatronics	1
Wind Speed and Direction Micro Response Monitoring System	Weathertronics Model 2035-S	1
Recording Thermo-Heated Precipitation Gauge	Climatronics	3
Sequential Sampler	GCA/Precision Scientific-63063	2
Impingers, Midget	Ace Glass 7531-10	25
Bubblers, Midget	Ace Glass 7352-10	25
	Ace Glass 7534-10	25
Flow Meters	Omega Engineering	2
Calibrated Orifice	GCA	3
Venturi Meters	GCA	1
Rotameters	Fischer & Porter	10
Recorders	Linear	4
	Esterline Angus Model MS-401-BB	2
Potentiometer	Thermo Electron Portable Digital Multimites	5
Condensation Nuclei Counter	Environment-One E1033A-001G1	1
Diffusion Battery	Environment-One E1033B-001G1	2
Wet Test Meter, 100 ft^3	GCA/Precision Scientific 63/23	2
Dry Gas Meter	Rockwell No. 1755	15

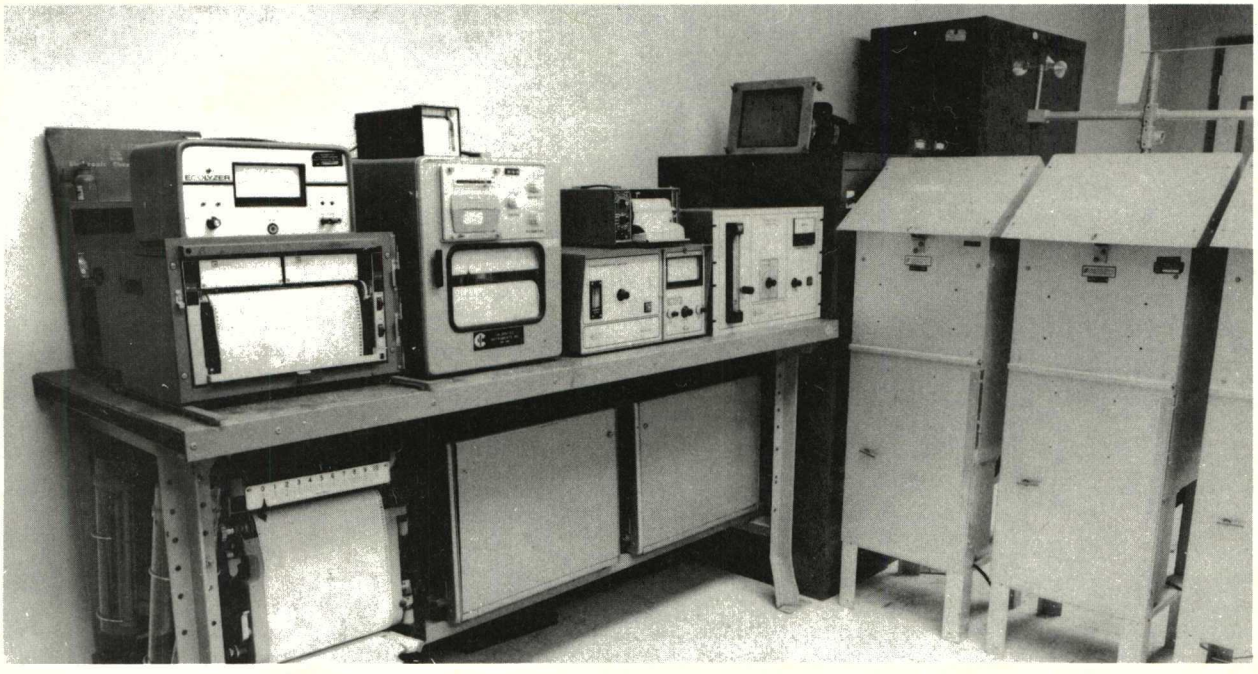
(continued)

TABLE III-1 (continued)

Item	Manufacturer	Quantity
Manometers, Vertical and Inclined		22
Pumps, Carbon Vane		13
Portable Generators, 2000 watts	Homelite	4
Portable Generators, 3500 watts	Homelite	1
Ice Machine, 400 pounds per day	Crystaltip	1
Portable FM Communications System	General Electric	11
Oxides of Nitrogen Analyzer	Thermo Electron Model 10AR	1
Conditioning System	Thermo Electron Model 800	1
Carbon Monoxide Analyzer	Horiba Model PIR 2000	1
Carbon Dioxide Analyzer	Horiba Model PIR 2000	1
Conditioning Equipment	GCA	2
SO_2 Analyzer	DuPont Model 400	1
SO_2 Analyzer	Horiba Model	1
NH_3 Converter	Fuji Electric	1



Instrument calibration



Ambient monitoring equipment

Figure III-2. Ambient monitoring laboratory at GCA/Technology Division.

of flue gas conditioning systems, extractive monitors, and chromatographic detectors. The data are collected and intercepted with the aid of strip chart recorders and a data acquisition system.

c. Fugitive--GCA/Technology Division has the capability to conduct a broad range of fugitive pollutant measurements. Gaseous species can be characterized using portable hydrocarbon analyzers, photoionization detectors, and specific pollutant detection tubes. The measurement of both total and respirable particulates can be made using a number of real-time particulate monitors developed by GCA.

GCA/Technology Division also has in its holdings an alternative to the FAST train consisting of a modified conventional high volume sampler using a high speed blower that closely approximates the performance specifications of the FAST train. The Reeve Angel 934 AH is used as the sampling filter. Also, a sorbent bed of XAD-2 resin is adapted to the Hi-Vol through which a 5-cfm sample is drawn.

d. Calibration Equipment--Also of importance to the conduct of ambient, source, and fugitive monitoring studies is the availability of calibration equipment that is capable of precisely and accurately defining the performance instrumentation. Some of the field calibration equipment which GCA routinely uses is described below.

- Monitor Labs Model 8500, PERMACAL Dynamic Calibration System--The Monitor Labs PERMACAL Dynamic Calibration System, Model 8500, is designed to provide precise concentrations of various common pollutants in otherwise purified air. The system can operate from its own internal pump and filtering system or from external air, or other gas sources. Permeation devices and/or chemical generators operating in a temperature-controlled environmental are used to provide precise amounts of pollutant compounds, which are diluted by flow-controlled purified air to provide precise concentrations of pollutant compounds for calibrating a wide variety of air quality monitoring and measuring devices. The Model 8500 is specifically designed for producing concentrations suitable for ambient air quality monitoring instruments. Our system uses permeation tubes in

calibrating for SO_2, NO_2, and H_2S, and a UV lamp generator in calibrating for O_3. It can also be fitted for dilution of cylinder gas, which then provides the capability of calibrating for compounds such as NO and hydrocarbons.

All Model 8500 calibrators have a temperature-controlled oven to house the permeation devices and the ozone generating lamp. The zero air is preheated to prevent cooling of the device during the dilution process.

- Flow Meters--GCA has 10 Fischer & Porter rotameter-type flowmeters, which have flow ranges that vary from 0.0000177 to 0.00152 cfm to 0.0705 to 2.40 cfm; we also have a Schutte and Koerting 0.50 to 5.4 cfm rotameter. Two GCA/Precision Scientific wet test meters are used as flowmeter calibration devices. (GCA's wet test meters are, in turn, calibrated against a 1.419 liter/cm spirometer, which services as a primary laboratory standard.)

2. Sampling

GCA/Technology Division maintains an extensive inventory of air, water, and solid waste field sampling and analysis equipment. The equipment routinely available for source sampling, itemized in Table III-2, is sufficient to maintain at least two field teams for an indefinite period of time and as many as five teams for short-term field tests. Field equipment is normally transported by one of the GCA vehicles whenever possible. Otherwise, special heavy-duty, shock-resistant containers are used to transport equipment by plane. Complete field laboratory facilities can be established in about 1 day.

A number of portable test devices not listed in Table III-2 are also available. These include pH meters, thermometers, colorimetric test kits, and a variety of flow measurement devices. A full complement of instruments and the associated apparati necessary for effluent and open water sample collection are maintained. Specialized electronics are available for the measurement of continuous monitoring of such parameters as dissolved oxygen, conductivity, salinity, pH, and temperature. Turner Design fluorometers can be used to provide supplementary information on the mixing

TABLE III-2. GCA/TECHNOLOGY DIVISION SAMPLING EQUIPMENT

Item	Manufacturer	Quantity
Wastewater Sampler, automatic sequential/composite	ISCO Model 2100	4
Recording Flowmeter	ISCO Model 1870	3
Sampling Pumps	Cole-Parmer	3
Kemmerer Water Sampler	WildCo	2
Portable Field Laboratory	Hach DR/EL 2	2
Dissolved Oxygen Meter	Yellow Springs Instrument	2
Conductivity Test Meter	Yellow Springs Instrument	2
Hankinson-Hestor Soil Sampler	A.H. Thomas 8262-40	2
SASS Sampling Train	Aerotherm 0050	2
Photoionization Analyzer	HNU Model PI 101	1
Fluorometer	Turner	1
Portable Gas Chromatograph with Flame Ionization (FI), Electron Capture (EC), Thermal Conductivity (TC), and Flame Photometric (FP) Detectors	AID 511	1
Portable Gas Chromatograph with Flame Ionization Detector (FID)	Carle 9700	1
Field Gas Chromatograph with Dual Column FID and FPD with Heated Gas Sampling Valve	Perkin-Elmer 3920B	1
Integrator (GC Data Reduction)	Spectra-Physics	1
Portable Organic Vapor Analyzer	Century Model OVA-108	2

(continued)

TABLE III-2 (continued)

Item	Manufacturer	Quantity
Hydrogen Generator		1
SO_2 Sampling Train	Scientific Glass	5
Goksoyr-Ross SO_3 Train	GCA	2
Particulate Sampling Train	Aerotherm HVSS	1
NO_x Sampling Train	Scientific Glass	7
Stack Sampling Train	RAC No. 2343	10
Additional Glass Sets	RAC No. 2343-SC2	3
Impactors	Andersen 2000 Inc.	
	Model 50-0002 In-stack	5
	Model 00564 cyclone Precollector	1
	HCSS High Capacity	2
Orsat Analyzers	Hays 621	2
	Fisher Type B	3
Pitot Tubes, various sizes		25
Pitot Tube Calibration		
Wind Tunnel	GCA	1
Gas Sampling Bulbs	Supelco	30
Gas Sampling Bags, Tedlar, various sizes	Horizon Ecology Co. 1412-60	
Pitots with Thermocouples, 36 in. to 146 in.	RAC/Thermo Electron	20
Potentiometer	Thermo Electric Portable Digital Multimite	5

(continued)

TABLE III-2 (continued)

Item	Manufacturer	Quantity
Condensation Nuclei Counter	Environment-One E1033A-001G1	1
Diffusion Battery	Environment-One E1033B-001G1	2
Wet Test Meter, 100 ft^3	GCA/Precision Scientific 63/23	2
Dry Gas Meter	Rockwell No. 1755	15
Manometers, Vertical and Inclined		22
Pumps, Carbon Vane		13
Portable Generators, 2000 watts	Homelite	4
Portable Generators, 3500 watts	Homelite	1
Ice Machine, 400 pounds per day	Crystaltip	1
Portable FM Communications System	General Electric	11

patterns of effluent plumes and flushing rates of streams, lakes, and estuaries. The Perkin-Elmer 3920 Field Gas Chromatograph (Figure III-3) can be used to characterize sulfur species (COS, H_2S, SO_2, methyl mercaptans) and total chromatographic organics (b.p. range, -160°C to 100°C; sensitivity, 1 ppm). Its versatility is enhanced when other columns and detectors are substituted.

Other portable testing devices include manual titration apparati, which may be set up in the field or in-house (Figure III-4) to determine specific parameters, such as SO_2 in the Federal Reference Method 6 test.

These facilities would be made available to the proposed program as required. Additional support equipment for special test setups includes carpenter and machinist hand and power tools and measuring equipment. Facilities exists for the design and construction of equipment for onsite monitoring, sample collection, and chemical characterization as required by the needs of the program.

a. Source Sampling--GCA/Technology Division routinely conducts sampling programs for the characterization of particulate and gaseous pollutants at stationary sources. All sampling programs are conducted in accordance with EPA Reference Methods.

A unique sampling train, used by GCA for EPA's environmental assessment measurement programs, is the Source Assessment Sampling System (SASS), shown in Figure III-5. The train consists of a stainless steel probe that enters an oven module containing three cyclones and a filter. Size fractionation is accomplished in the cyclone portion of the SASS train, which incorporates three cyclones in series to provide large quantities of particulate matter size-classified into three ranges: (1) greater than 10 μm, (2) 3 μm to 10 μm, and (3) 1 μm to 3 μm. Together with a standard 142-mm filter, a fourth cut of less than 1 μm is obtained. Volatile organic material is collected in an XAD-2 polymeric resin sorbent trap, which is capable of collecting a broad range of organic compounds. Volatile inorganic material is collected in a series of impingers. The pumping capacity for the system is supplied by two 10-cfm high-volume pumps. Sampling

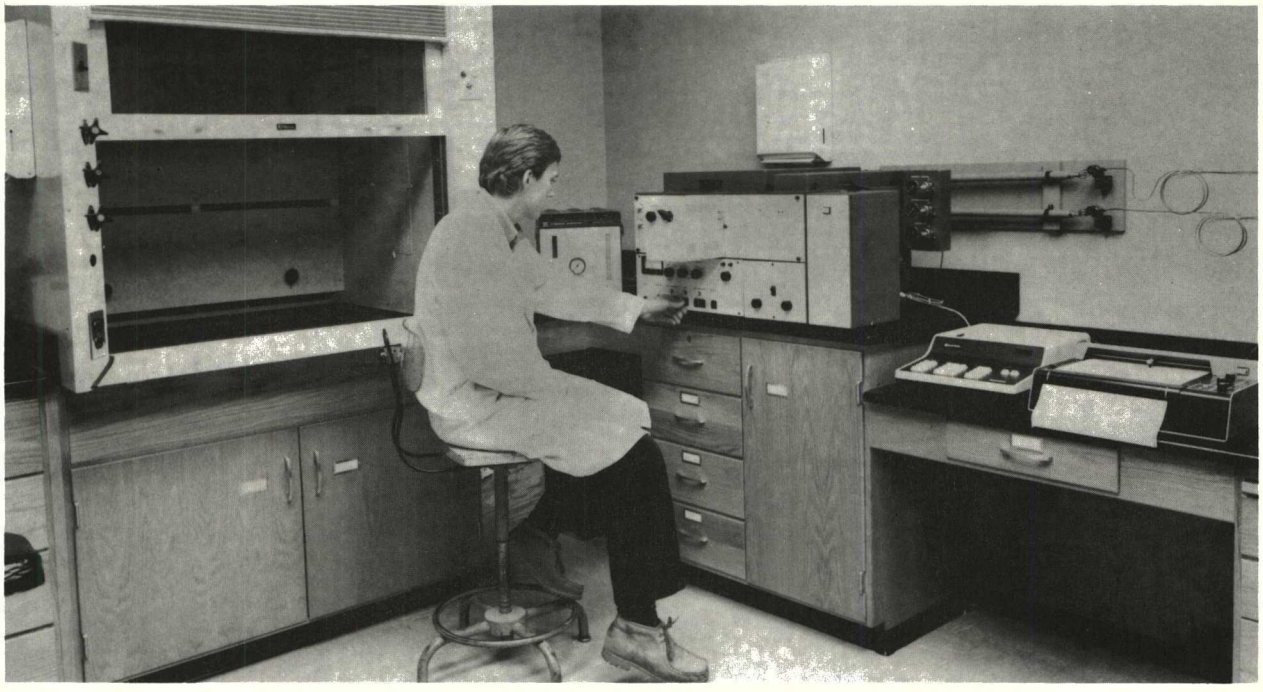


Figure III-3. In-house calibration of Perkin-Elmer 3920 field gas chromatograph

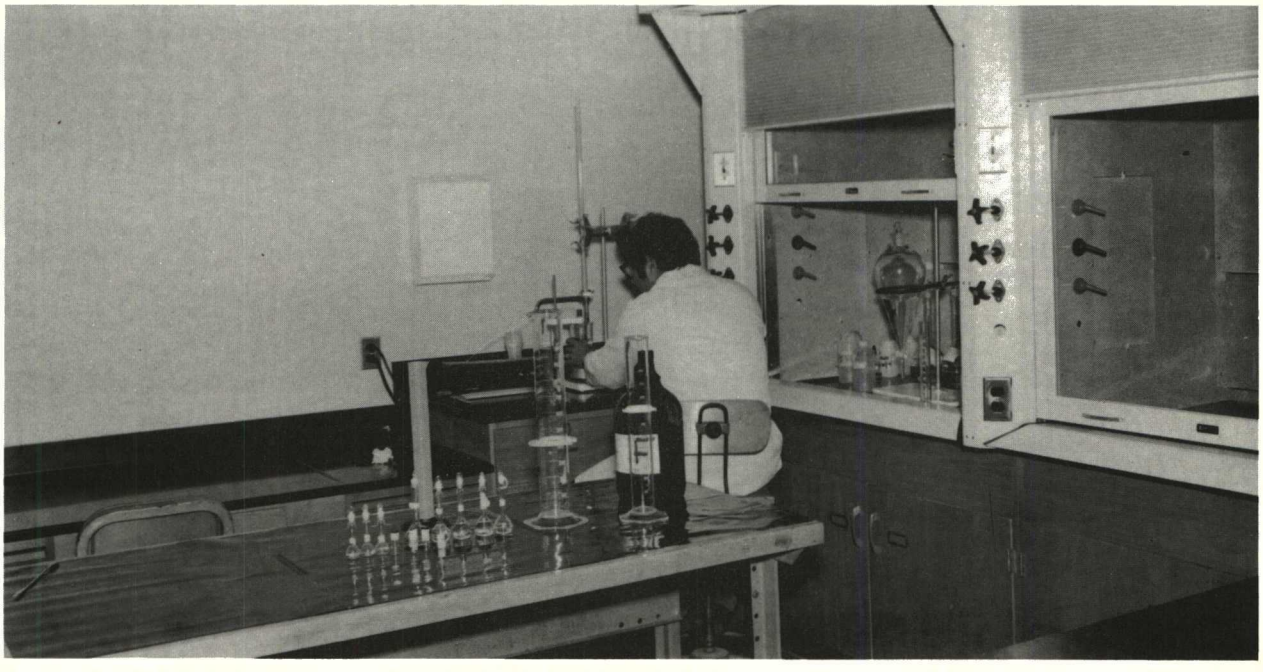


Figure III-4. Titration of reference method 6--SO_2 determination.

parameters, such as pressure, temperature, power, and flow, are controlled and monitored by the system main controller. The SASS train is routinely washed, assembled, and maintained in the staging area, shown in Figure III-6, according to a systematic program, by GCA/Technology Division personnel.

Other atmospheric source sampling equipment is also available to meet the specific demands of a particular project. Andersen impactors, used for particle sizing; impinger train systems, containing particular solutions to entrap specific chemical species; and continuous monitor systems, analyzing a number of chemical species concurrently and continually, are examples.

b. Water/Wastewater Sampling--The Environmental Measurements Department of GCA/Technology Division maintains a broad capacity in water and wastewater sampling. Available sampling equipment, some of which is listed in Table III-2, includes sample collection devices and test equipment for onsite analyses, and materials for proper sample preservation, shipment, and storage. In addition to these general types of manual and automatic water/wastewater sampling devices, GCA/Technology Division has the necessary support services and facilities to design and fabricate specialized sampling equipment that may be required by a particular sampling program. Sampling manifolds, leachate/ground water sampling systems, and in situ sampling/analysis/recording trains are examples.

c. Solids Sampling--Sampling solids in the field, in many cases, consists of procuring the solid material by using an auger and dry-tube coring methodology. In this procedure, a hole is opened to the desired sample depth by augering, and a "dry-tube" core sampler, consisting of a Teflon tube approximately 50 cm in length and 8 in diameter, is positioned on the bottom of the hole and pushed into the undisturbed strata. A plunger can be used to expel the sample easily.

When industrial facilties are sampled, three manual grab sampling techniques are used: boring techniques, which include pipe or thief sampling; shovel or grab sampling; and auger sampling. Raw material piles of relatively large size (aggregate piles, coal feed, etc.) are sampled using a

Figure III-5. Personnel assembling the Source Assessment Sampling System (SASS).

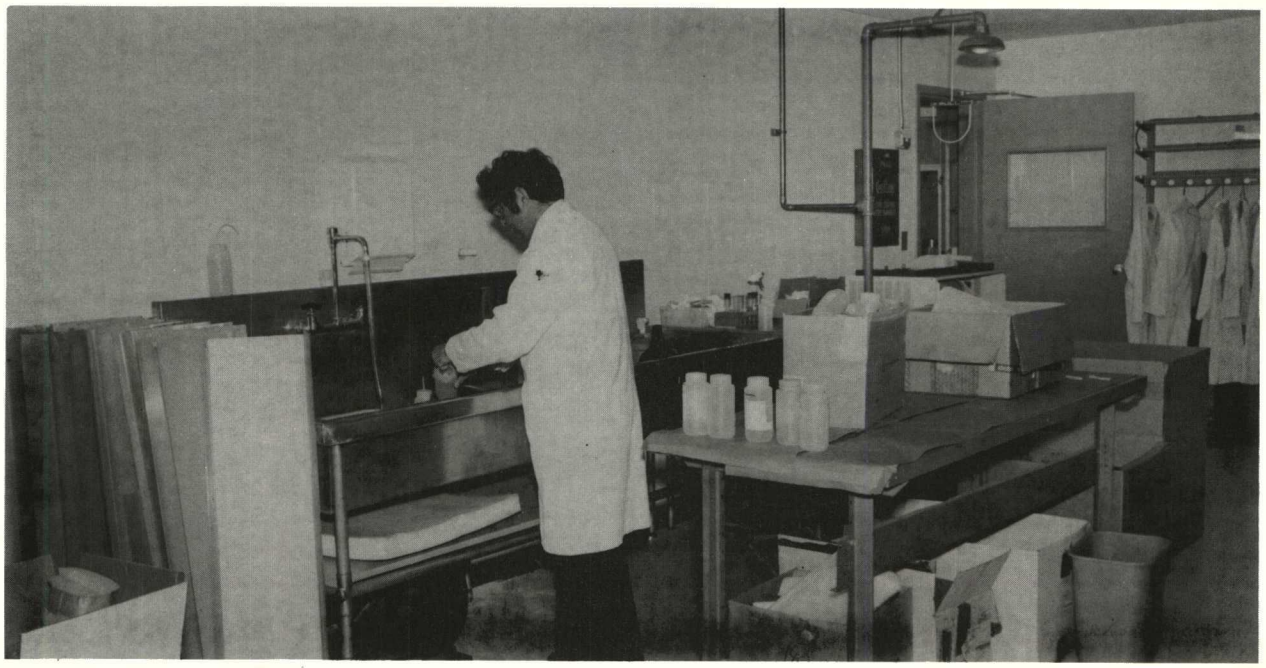


Figure III-6. A portion of one staging area.

fractional shoveling technique to acquire a representative sample across the conveyor. Pipe borers are used when sampling materials are stored in piles, silos, or bins. Auger samplers, using a form of drill, are used when the solid material is too tightly packed to admit pipe borers.

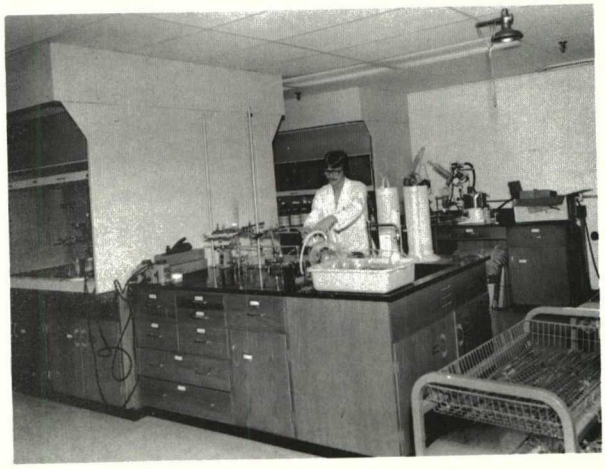
B. ANALYTICAL CHEMISTRY LABORATORY

GCA's analytical chemistry laboratories are routinely used in the assessment of multimedia environmental samples. The analytical procedures necessary for this program will require, in addition to versatile wet laboratory facilities, a variety of available state-of-the-art instrumentation.

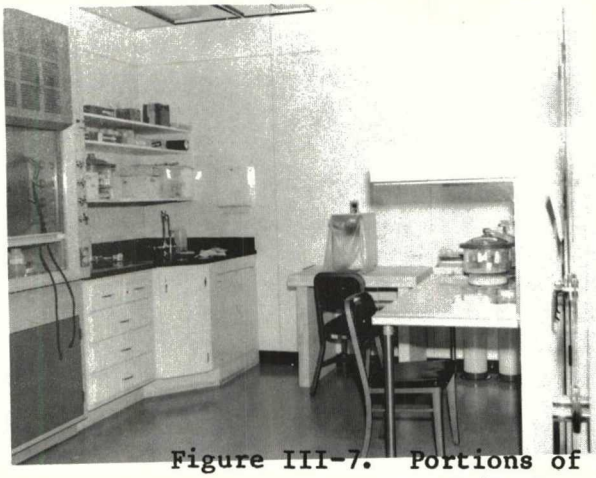
GCA's analytical chemistry laboratories are fully instrumented and equipped to conduct investigations on water, air, and solid samples. The laboratories are staffed with two chemists at the doctorate level, three chemists at the masters level, 10 chemists at the bachelors level, and two technicians. The analytical laboratory personnel have extensive experience in analytical procedures for the determination of trace organic and inorganic constituents of environmental samples, as well as standard methods of chemical analysis and the quality control procedures that are an integral part of all GCA programs.

GCA/Technology Division maintains in-house laboratory facilities sufficient to conduct all organic and trace element characterizations necessary for the successful completion of tasks envisioned under the proposed effort. Recent expansion of the analytical laboratories has increased the laboratory space available to the proposed program to approximately 5,000 square feet to provide for the addition of several instrument and wet chemistry laboratories (shown in Figure III-7). Gas Chromatography/Mass Spectrometry (GC/MS), Inductively Coupled Plasma Spectrometry (ICAP), flame/flameless Atomic Absorption (AA), and Gas Chromatography with various detectors are routinely used for sample analysis. Highlighted below are descriptions of GCA's laboratory instrumentation most relevant to the organic and inorganic analysis of industrial wastes. Selected analytical facilities are shown in Figures III-8 through III-12.

Inorganic wet laboratory

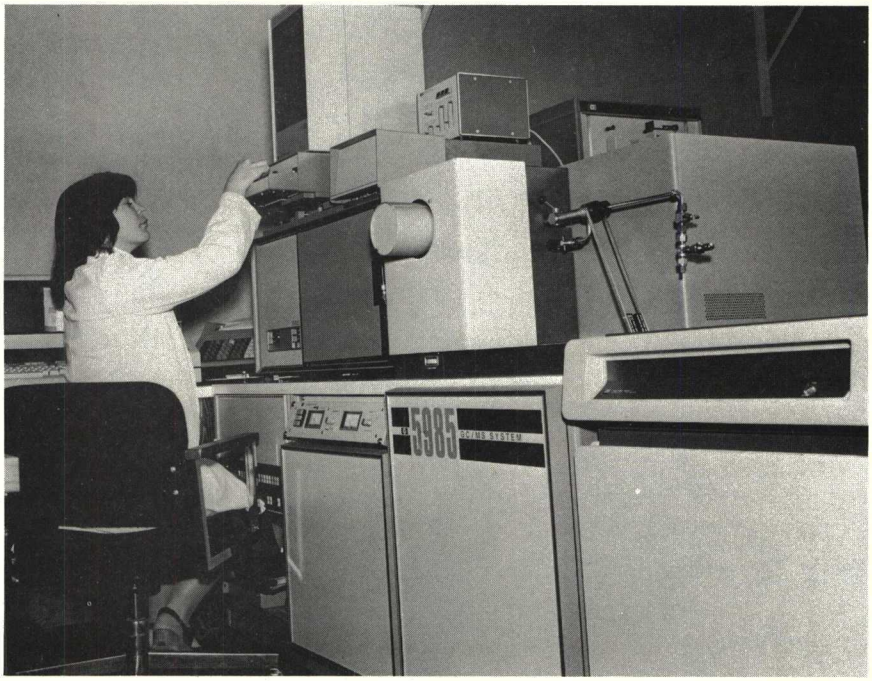


Organic wet laboratory

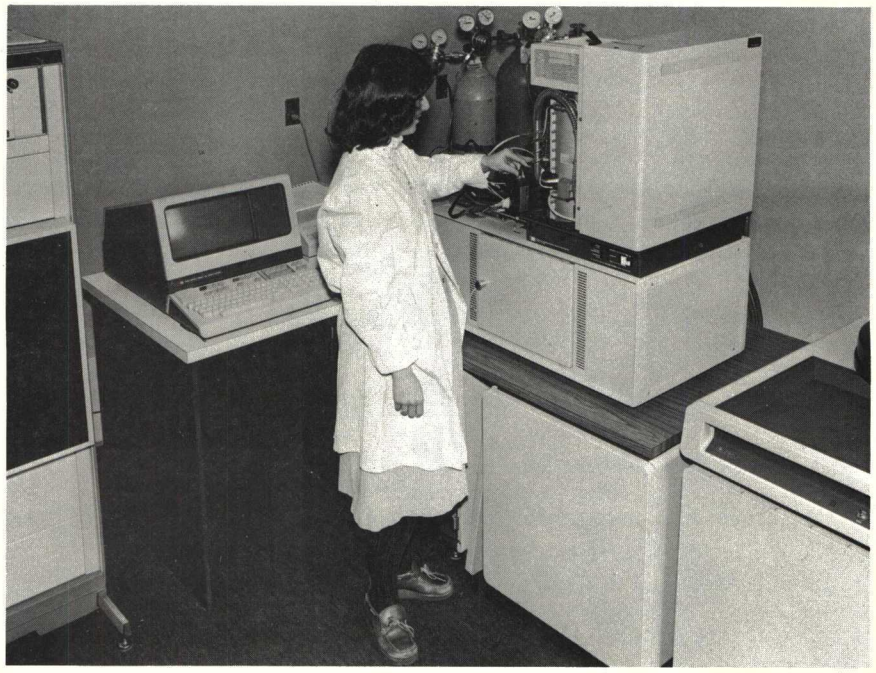


Sample preparation laboratory

Figure III-7. Portions of recently expanded Chemistry Laboratories at GCA/Technology Division.



Hewlett-Packard 5985 combined gas chromatograph
and mass spectrometer with data system

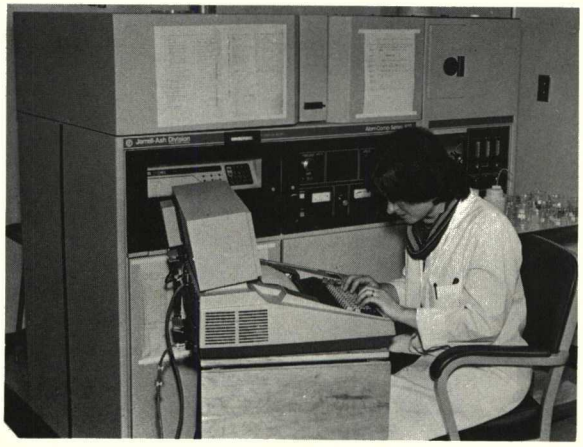


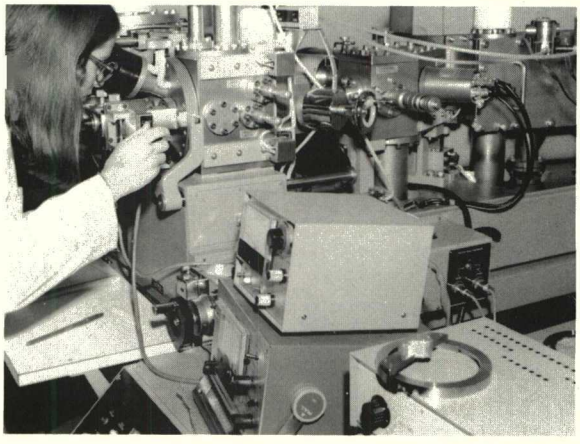
Hewlett-Packard 5993 combined gas chromatograph
and mass spectrometer with data system

Figure III-8. Selected analytical instruments from GCA/Technology Division chemistry laboratories.

Varian AA6 atomic absorption spectrophotometer

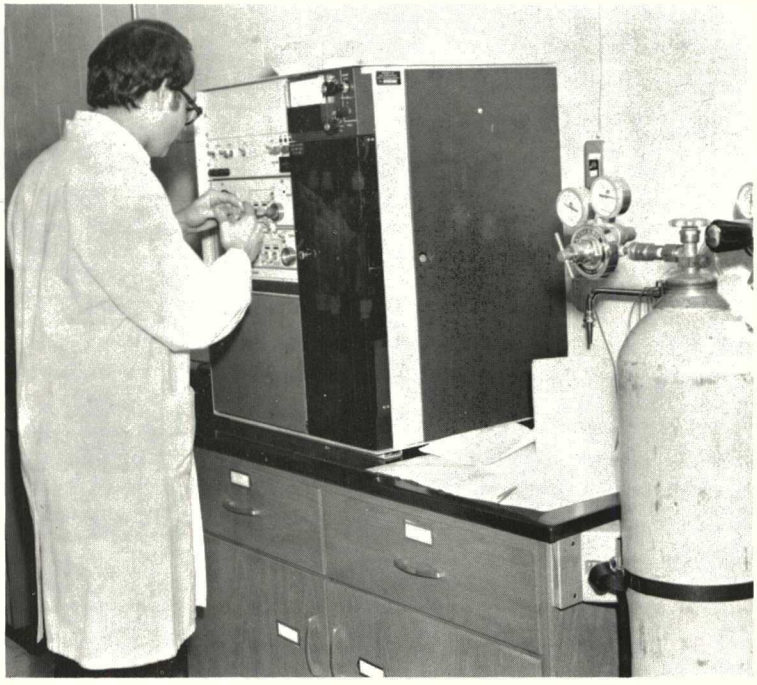
Inductively coupled plasma spectrometer



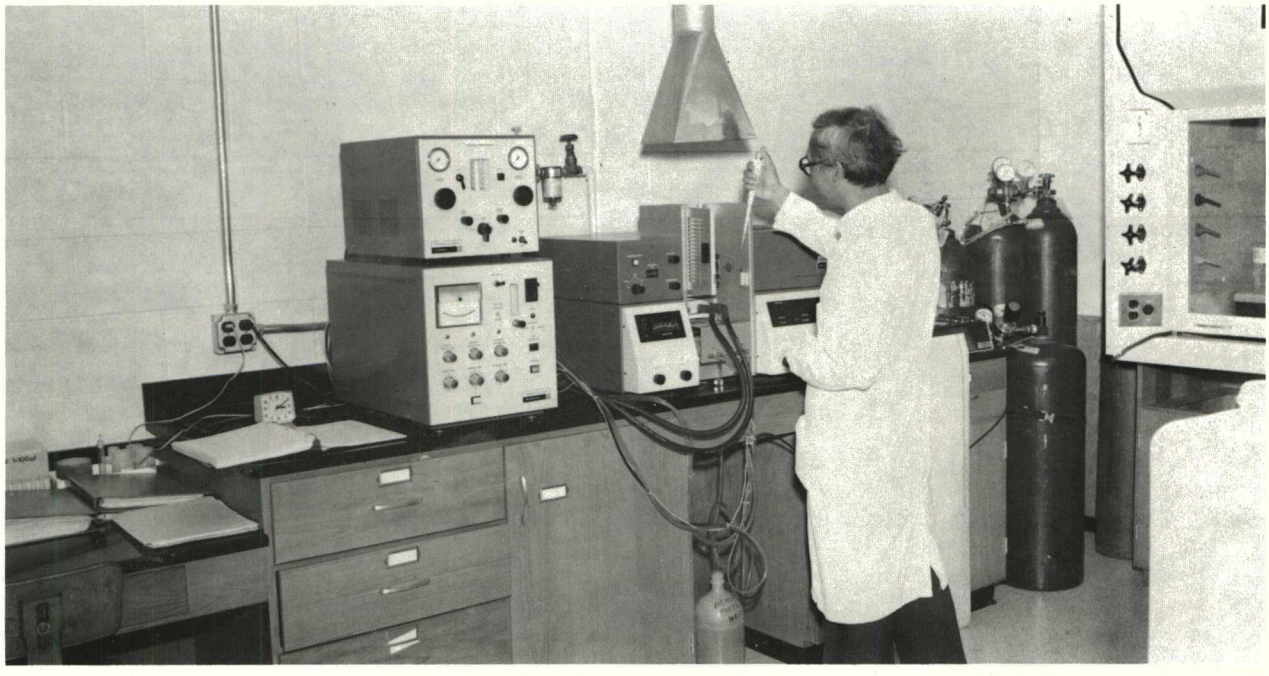


JEOL JMS-01BM-2 spark source mass spectrograph

Figure III-9. Selected analytical instruments from GCA/Technology Division chemistry laboratories.

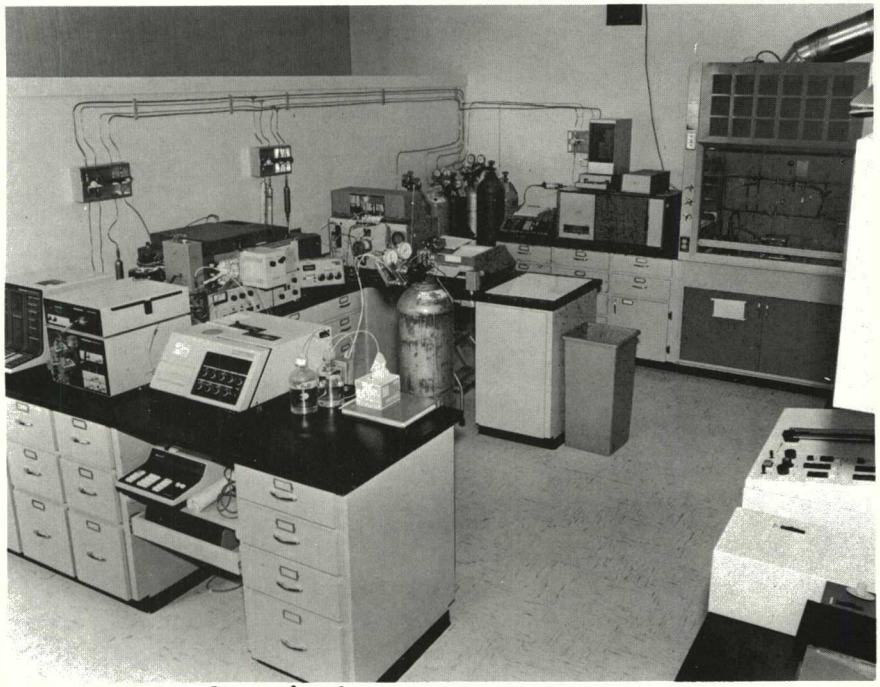


Dionex 14 ion chromatograph

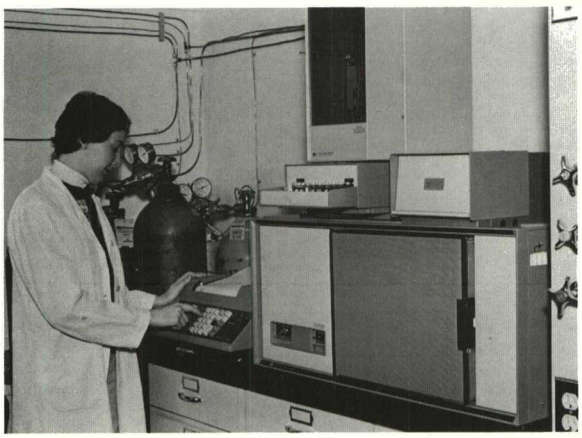


Perkin-Elmer 460 atomic absorption spectrophotometer with graphite furnace

Figure III-10. Selected analytical instruments from GCA/Technology Division chemistry laboratories.



Organic instrument laboratory



Hewlett-Packard 5840 gas chromatograph with ECD and FID detectors and auto sampler

DuPont 850 high pressure liquid chromatograph with Perkin-Elmer LC-75 UV spectrophotometer detector and 650-105 Fluorescence spectrophotometer detector

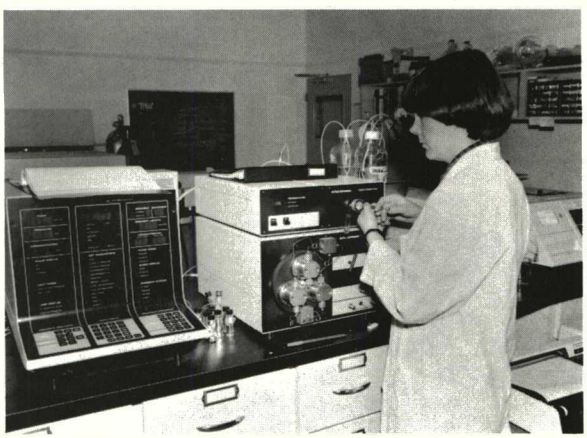
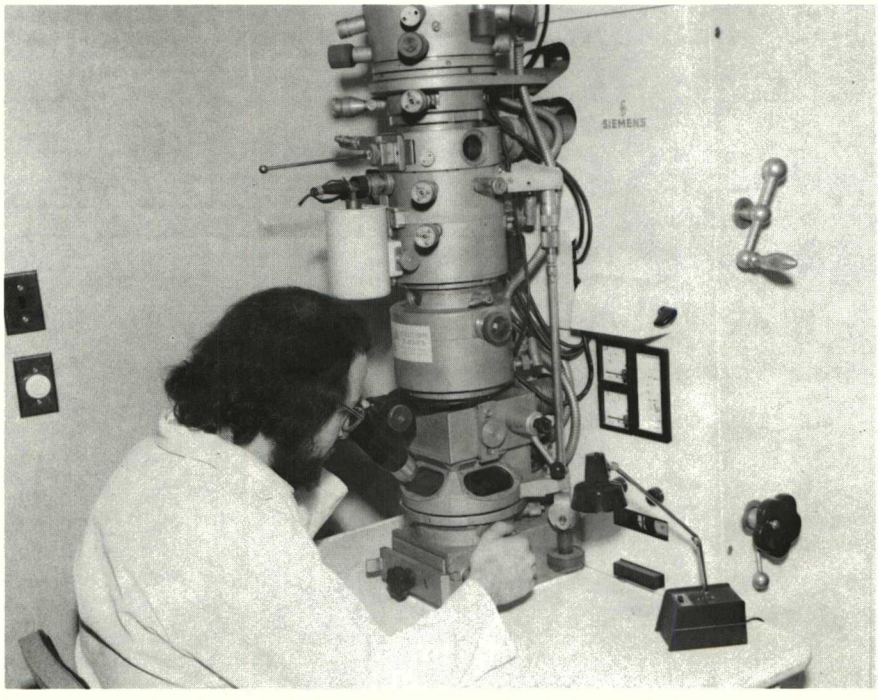


Figure III-11. Selected analytical instruments from GCA/Technology Division chemistry laboratories.

GCA/McPherson ESCA 36 X-Ray Photoelectron Spectrometer



Siemens transmission electron microscope

Figure III-12. Selected analytical instruments from GCA/Technology Division chemistry laboratories.

- The Hewlett-Packard 5985 GC/MS uses a quadrupole mass analyzer that offers high sensitivity and resolution. The mass analyzer uses hyperbolic rods and a Kruger ion-lens arrangement that greatly improves the high mass response. This combination produces spectra that are quite comparable to spectra found in the data system libraries commonly used. The HP 5985's source is designed such that both the EI and CI modes of operation are optimized and are instantly interchangeable. The source is also equipped with a direct insertion probe (DIP). To optimize the gas chromatographic resolution, a capillary inlet system (the HP 18835 Split-Splitless Injection System) and either glass or fused silica capillary column can be used. The HP 5985 GC/MS is also equipped with a flame ionization detector and a Hewlett-Packard 5840A GC terminal. With these options, both flame ionization and mass chromatographs can be obtained from the same injector-column configuration, and dual GC/FID/MS operation is possible. In addition, the 5840 GC terminal serves as a separate "microcomputer" to control GC runs, analyze data, and perform post-run calculations. The mass spectrometer uses all digital electronics, and the gas chromatograph is microprocessor-controlled. Therefore, both instruments can be easily controlled by the data system without critical interfacing units. The HP 5985 data system has been fully developed. Combining the HP software with the new 50-megabyte disk system results in an extremely powerful data system with multiple libraries. Besides the usual capabilities available with a GC/MS data system, the HP 5985 data system has a hardware/software option (AUTOTUNE) that automatically tunes the mass spectrometer to identical specifications for every run; complete facilities for user-initiated calculations and programming, including compilers for FORTRAN II and IV, ALGOL and Assembly languages, and an expanded basic interpreter; and simultaneous data acquisition and reduction programs. Moreover, a BATCH PROCESSOR system that can automatically control the GC/MS/DS is available to perform all operations from specifying GC and MS conditions through subtracting the background contribution and determining GC retention times and peak areas, to plotting mass spectra, conducting library searches, and tabulating all results. The new NIH/EPA/MSDC Mass Spectral Data Base obtained from NBS has been installed in our system and is updated continuously.

- The Hewlett-Packard 5993 GC/MS, a quadrupole instrument, is equipped with a Chromalytics 1047 concentrator for purge and trap analysis of volatile organic compounds. The instrument is fully computer controlled with a data system consisting of state-of-the-art hardware similar to that of the 5985 GC/MS. Although used primarily for the analysis of volatile organics in water and wastewater, it also serves as backup to the HP

5985 GC/MS for analysis of semivolatile organics. An additional system configuration includes a thermal desorption apparatus for analysis of volatile organic compounds in air. The HP 5985 is equipped with both capillary and packed column capabilities, a full library/spectrum matching function, and a large 50-megabyte disc storage capacity. A magnetic tape recorder interface provides archival storage of all sample data points.

- The Chromalytics 1047 Concentrator, adaptable to any GC, combines differential adsorption and thermal desorption to achieve reproducible, quantitative analyses of ppb concentrations of pollutants in gas or liquid samples. Injected samples congregate at the head of the trap and solvents are vented. When the backflush is activated, the adsorbed material is thermally desorbed and swept into the GC in a concentrated form.

- The Jarrell-Ash Model 855 Inductively Coupled Plasma Spectrometer(ICP) uses an argon plasma and polychromator for the simultaneous analysis of 20 elements. These elements include Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se, Ti, Tl, V, and Zn. The ICP is equipped with an N+1 channel that permits the analysis of any element that emits light in the 190- to 800-nm wavelength range. Thus, elements in addition to those listed above can be measured. The N+1 channel consists of a 0.275 m monochromator and can perform wavelength scans with the monochromator's separate recorder output. The Model 855 uses a radio frequency generator to induce a plasma in an argon atmosphere. This excitation source eliminates chemical interferences because the plasma's high temperature ensures complete sample dissociation. The optical thinness of the plasma also extends the linear concentration over several orders of magnitude and decreases the need for sample dilution. The focal curve has predrilled holes for the exit slits of the most widely used spectral lines. Each slit is centered exactly on its spectral line to better than 5 m by means of quartz, corex, or glass refractor plates, which also filter any stray radiation. Behind each exit slit is a 13 mm diamter photomultiplier tube. The Model 855 has a background correction system that can compensate for continuum background problems. Spectral overlap is compensated by interelement correction factors, which are entered into a PDP-8 computer. The PDP-8 minicomputer performs all management functions, data collection, and analysis. Communication with the ICP is conducted through a Texas Instrument Silent 733 electronic printer. The printer uses cassette magnetic tapes for loading programs and storing data.

- The Varian Model AA-6 Atomic Absorption Spectrophotometer is a superior AA instrument. The quality and reliability of the AA-6 have served as standards for other AA instruments. The greater efficiencies of the optical and nebulization systems for flame analyses produce detection limits that are lower than those of other instruments. Four lamps may be warmed up simultaneously, which permits rapid change to another element. The Model AA-6 can be used with background correction if the need arises. The Model AA-6 is also equipped with the CRA-63 Graphite Furnace for the analysis of metals at trace levels. The CRA-63 uses a sample volume of 5 1. The analysis of arsenic, selenium, and antimony by hydride generation methods and the determination of mercury by the cold vapor technique can also be done on the instrument.

- The Perkin-Elmer Model 460 Atomic Absorption Spectrophotometer is an exceptionally powerful and versatile instrument for the analysis of trace elements. The 460 provides digital readout of sample absorbance of concentration depending on the operations mode chosen. In the concentration mode, the instrument is capable of fitting the absorbances of standard solutions to a concentration curve as much as six times above the linear working range. This facilitiates analysis of high concentration samples without dilution. A Deuterium Arc Background corrector is regularly used in arsenic and other analyses requiring such correction. In addition to atomic absorption analyses, flame emission measurements are made when standard methods provide insufficient precision. GCA's Model 460 is equipped with the HGA-2100 Graphite Furnace for low-level measurements. Flameless analysis of both solid and liquid samples can be performed using the Graphite Furnace, with detection limits an order of magnitude lower than those with conventional AA. The HGA-2100 also requires a much smaller sample size than that required by flame analysis. Additionally, hydride generation is regularly used for arsenic, antimony, and selenium analyses at GCA, and the cold vapor technique is used for low-level mercury analyses.

- The Perkin-Elmer Model AS-40 Auto Sampler permits samples to be analyzed by flameless AA without constant operator attention. The unit consists of a microprocessor-controlled programmer and a sampler. This accessory is equipped with automatic zero setting and calibration with three standards, and can analyze up to 35 samples. The AS-40 can dispense sample volumes of 5 to 99 µl (selectable in increments of 1 µl) with automatic flushing of the pipetting system between injections. Replicate determinations from 1 to 99 can be performed on a single sample cup. In addition to direct analysis of samples, the AS-40 can perform automatically the method of additions and matrix

modification. The method of additions can be done either using samples premixed with standard solution or with addition of the standard directly to the sample in the graphite tube.

- The Hewlett-Packard 5840 Reporting Gas Chromatograph is a dual-column instrument equipped with both electron capture and flame ionization detectors. An HP 7671A Automatic Sample Injector increases the efficiency of the instrument by allowing continuous analysis of up to 36 samples with a minimum of operator time. Precise instrument operation and data manipulation are achieved through microprocessor control. Through the extensive choice of available columns, analysis of a wide range of compounds is possible; and with the use of either the ECD or the FID, the 5840 is capable of detecting nanogram-range quantities of material.

- The Perkin-Elmer Model 3920B Gas Chromatograph is a dual-column modular instrument equipped with both flame ionization and electron capture detectors. Precise column temperature control (from ambient to 400°F) is ensured by the programmable oven and an automatic oven door system, which also minimizes system downtime between analyses. The 3920B is equipped with heated injection ports, a glass open tubular column system, and a gas sampling valve. In addition, an effluent splitter for component collection allows repetitive fraction separation.

- The Tracor 560 Gas Chromatograph is a dual-column instrument equipped with dual flame ionization detectors. These can be operated in a single or differential mode. The latter can be used to minimize background noise. The completely digital programmer provides control of oven temperatures from 50°C to 399°C $\pm$ 1°C. In addition to an automatic zero control, the oven is designed to allow for removal of either column without disturbing the other and features an automatic cooling device.

- The DuPont Model 850 Liquid Chromatograph serves as the basis for our state-of-the-art HPCL systems. The two-head pump design provides a continuously adjustable flow range of 0.1 cm^3/min to 10 cm^3/min with a constant flow precision of better than 1 percent. The microprocessor-controlled column compartment ensures constant temperature of column, solvent introduction and sample injection. The compartment houses a maximum of six 30 cm columns and also contains a vapor alarm to guard against leaks of volatile solvents.

- Perkin-Elmer 650-10S Fluorescence Spectrophotometer is an automatic scanning instrument in the wavelength range 220 nm with an accuracy of $\pm$ 2 nm or better. Powered by a 150-watt xenon lamp, this detector can function both as a liquid

chromatography detector and a laboratory spectrophotometer. It has a variable scan speed selector and continuously variable precision slits adjustable from 1.5 to 20 nm. The automatic scanning accessory can be microprocessor-controlled allowing preprogrammed changes in scanning wavelengths.

- Perkin-Elmer Model LC-75 Spectrophotometric Detector is a totally dedicated LC detector with a variable wavelength in the range of 190 to 600 nm $\pm$ 1 nm. Slit widths are equivalent to 3.8 nm at 240 nm. It has a full selection of sensitivity in the range 0.01 to 5.12A full scale with a 1 cm flow cell. The UV detector is supplemented with the LC-75 autocontrol module possessing both push-button absorbance rationing and spectral scanning capabilities. The autocontrol module possesses 12k memory and a fully functional control keyboard fitted with autozero, and LED readouts of absorbance, stored wavelengths, and other pertinent data functions.

- Dionex Corporation Model 14 Ion Chromatograph (IC) is a powerful instrument for inorganic analysis that combines the separation capabilities of ion exchange with the sensitivity and universality of conductimetric detection. The instrument offers excellent precision for both anions and cations down to the ppb level and is especially well suited to the analysis of samples in a complex matrix. With IC, it is possible to analyze for several anions or cations with one sample injection, even if the ions are not in the same concentration range. IC can also be used to analyze for organic acids, amines, organic phosphates, and quaternary ammonium salts.

- Perkin-Elmer Model 283 Infrared Spectrometer is a powerful tool for both qualitative and quantitative analyses of a variety of sample types. The 283 is a high resolution instrument with excellent sensitivity and it is a microcomputer-controlled, which greatly enhances the accuracy and reproducibility of the analyses. It covers the spectral region of 2.5 μm to 50 μm (4,000 cm^{-1} to 200 cm^{-1}) and therefore is capable of analyzing for both organic and inorganic compounds. The 283 can be used to analyze gas, liquid, and solid samples and has accessories for microsample analysis. It is equipped with an ordinate data processor that accepts calibration data and yields direct concentration data. The instrument can also be interfaced to a larger computer system that allows for incresed data handling capabilities.

- Varian Model DMS80 Ultraviolet/Visible Spectrophotometer is equipped with a grating monochromator and can be used in either the double beam or single beam mode. It covers the ultraviolet range of 190 to 350 nm with an air-cooled deuterium arc source

and the visible range of 350 to 900 nm with a quartz-halogen lamp. The instrument has a wavelength accuracy of +0.5 nm with a wavelength reproducibility of +0.25 nm. It has a four-digit electronic readout and can be used in the absorbance, percent transmission, concentration, or first and second derivative modes.

- The JEOL JMS-01BM-2 Spark Source Mass Spectrograph (SSMS) is used for elemental analysis of solids and liquids. The instrument is designed to carry out high sensitivity trace element analysis on a wide variety of materials and is particularly suited for the analysis of envrionmental samples such as particulates, feed fuels and miscellaneous liquid and solid wastes. The JMS-01BM-2 is a high resolution double-focusing mass spectrograph with Mattauch-Herzog ion optics. It is equipped with an rf-spark and photoplate detection. The instrument has a mass resolution of 10,000 and parts-per-billion atomic sensitivity. All elements are detected simultaneously with a single exposure covering a mass range of mass ratio 1:36; e.g., Li to U in a single exposure.

- The GCA/McPherson ESCA 36 X-Ray Photoelectron Spectrometer is a powerful tool for investigating particulate and solid surface chemical properties. This state-of-the-art instrument uses a low energy X-ray beam to eject core electrons from elements located within 20A of a solid surface. The measured kinetic energies of these electrons identify not only the elements present, but also the oxidation states of those elements. The ESCA 36 is completely computer-operated and is capable of handling up to eight samples simultaneously.

- The Orion Research 701A Digital pH/mV Meter accepts standard pH and chemical sensing electrodes to provide precise measurements in a variety of analytical applications. The 701A covers a range of +1,999.9 mV with +0.1 mV precision in both the absolute and relative millivolt modes. Two pH modes are available, 0.01 pH scale with +0.01 pH relative accuracy. The choice of pH mode is determined by the quality of the pH and reference electrodes used. The meter also has a temperature compensator that adjusts electrode slope during calibration or temperature change in the pH mode.

- The Siemens Transmission Electron Microscope (TEM) is used for the examination of specimens transparent to electrons. Crystalline phases can be identified using selected area electron diffraction (SAED) where the crystallographic orientation is known.

- Philips Model XRG-2500 X-Ray Diffraction Unit is standard instrumentation for the identification of crystalline phases. A 114.6 mm diameter Debye-Scherrer power camera built by the Charles Supper Company is used for identification and determination of crystallographic constants of small amounts of crystalline materials.

- The Analytical Instrument Development Corp., Model 511, Gas Chromatograph is a very versatile instrument equipped with flame ionization, electron capture, thermal conductivity and flame photometric detectors.

- The Carle Model 9704 Gas Chromatograph uses flame ionization detection and is equipped with a 10 ft x 1/8 in., 15 percent Squalene-on-Chromasorb, PAW 80/100 mesh column and a series of valves including a gas sampling valve and a back-flush valve. This combination is designed for analysis of low molecular weight hydrocarbons in gaseous samples.

- Perkin-Elmer Model 457 Infrared Spectrometer is a basic tool for organic chemical analysis. It covers the fingerprint region of 2.5 m to 50 m (4,000 cm^{-1} to 200 cm^{-1}). The 457 can be used to analyze liquid and gas samples as well as solid samples in an alkaline halide matrix. The ease of calibration, variable scan speeds, scale expansion capabilities, accuracy and resolution of the 457 make it a powerful tool for both qualitative and quantitative analysis.

- The ISCO Model 312 Metering Pump is a general purpose, precision laboratory pump providing calibrated flow rates to 500 ml per hour at pressures to 200 psi. The materials in the pump that are in contact with the flow stream are Teflon, Kel-F and an extremely corrosion-resistant superalloy, Hastelloy C. These materials are resistant to almost all organic solvents and most corrosive materials. When this pump is combined with the ISCO Model 328 Fraction Collector, appropriate columns and any of the detectors previously described, a system capable of preparative scale, low or medium pressure chromatography with unattended fraction collection is obtained.

- The ISCO Model 328 Fraction Collector provides for the unattended collection of up to 190 discrete fractions of a flowing effluent stream. The size of these fractions may be controlled by time, volume drops, external control signal from the detector or manually, depending on how the controller is set by the operator.

- The Hewlett-Packard Model 3380S Integrator reduces the time required for quantitative analysis of gas chromatographic data by a factor of five. This graphic integrator plots and

annotates GC spectra on "Z-folding" 8-1/2 x 11 in. paper and prints integrated area percentages at the end of each analysis. Seven different parameters for peak analysis may be varied manually or controlled automatically by the 3380S. The 3380S is capable of handling the output of several instruments; thus, peak analysis of the atomic absorption spectra, high pressure liquid chromatograms, optical transmittance data, and gas chromatographs can be collected.

- The Spectra-Physics Minigrator significantly reduces the time required for quantitative analysis and allows for the automation of GC analysis and data reduction. A variety of functions can be programmed to provide accurate peak area integration. The output from the Minigrator can be readily delivered to GCA's Analytical Laboratory data system for further data analysis.

- Recording Microdensitometer--Jarrell Ash.

- Electronic Microbalance--Mettler ME22 with BA25 autotare.

- Four Mettler Analytical Balances.

- Mettler 57700 Air Pollution Weighing Chamber for use with the H54/AR balance.

- pH Meter--Beckman/Zeromatic SS3.

- Polarizing (Petrographic) Microscope--Vickers M72C.

- Image Shearing Eyepiece.

- Microscope--American Optical Binocular.

- Microscope--Bausch & Lomb.

- Optical Comparator--Jones & Lamson PC-14A.

- Selective Ion Electrode--Fisher 13-639-90 (pH)

- Selective Ion Electrode--Orion 92-17-00 (Cl^-, Membrane).

- Selective Ion Electrode--Orion 94-17A (Cl^-, Solid State).

- Selective Ion Electrode--Orion 94-09A (F^-, Solid State).

- Reference Electrode--Orion 90-01-00 (Single Junction).

- Reference Electrode--Orion 90-02-00 (Double Junction).

- Reference Electrode--Orion 13-639-52 (Calomel).
- Electrometer (for use with Selective Ion Electrodes)--Data Precision/2540AL.
- Temperature Control Bath--GCA/Precision Scientific.
- Freas 815 BOD Incubator.
- Thin Layout Chromatography Apparatus--Analabs and Supelco.
- Transmittance Meter--Bausch & Lomb.
- Viscometer--LVF.
- Mixer/Mill Sample Homogenizer--Spex Industries.
- Electrode Press--Beckman.
- Miscellaneous equipment such as muffle furnaces, tube furnaces, vacuum ovens, drying ovens, oxygen bombs, acid digestion bombs, etc.
- Support equipment such as power supplies, frequence counters, oscilloscopes, etc.

C. INSTRUMENTATION DEVELOPMENT

1. Engineering Laboratory

This laboratory is staffed with experienced mechanical, electrical and electronics engineers; and electronic and mechanical technicians. They have at their disposal the necessary mechanical and electronic (power supplies, oscilloscope, digital voltmeters, signal generators, function generators, wave analyzers, etc.) apparatus to evaluate new instrumentation or modify existing equipment.

2. Aerosol Research and Measurement Facility

Figure III-13 presents a photograph of a major section of the Aerosol Research and Measurement Area, and Figure III-14 presents a view of the wind tunnel facility which we utilize to calibrate aerosol and gas stream

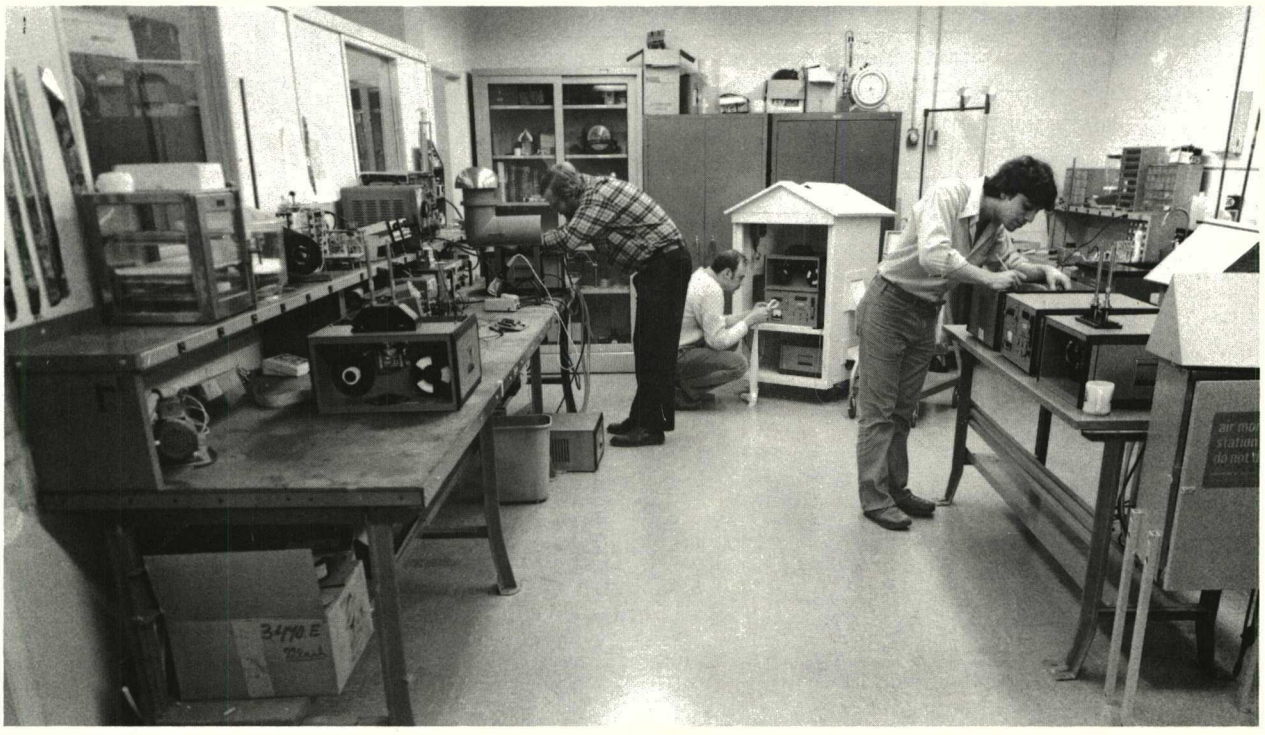


Figure III-13. Section of Aerosol Measurement Laboratory.

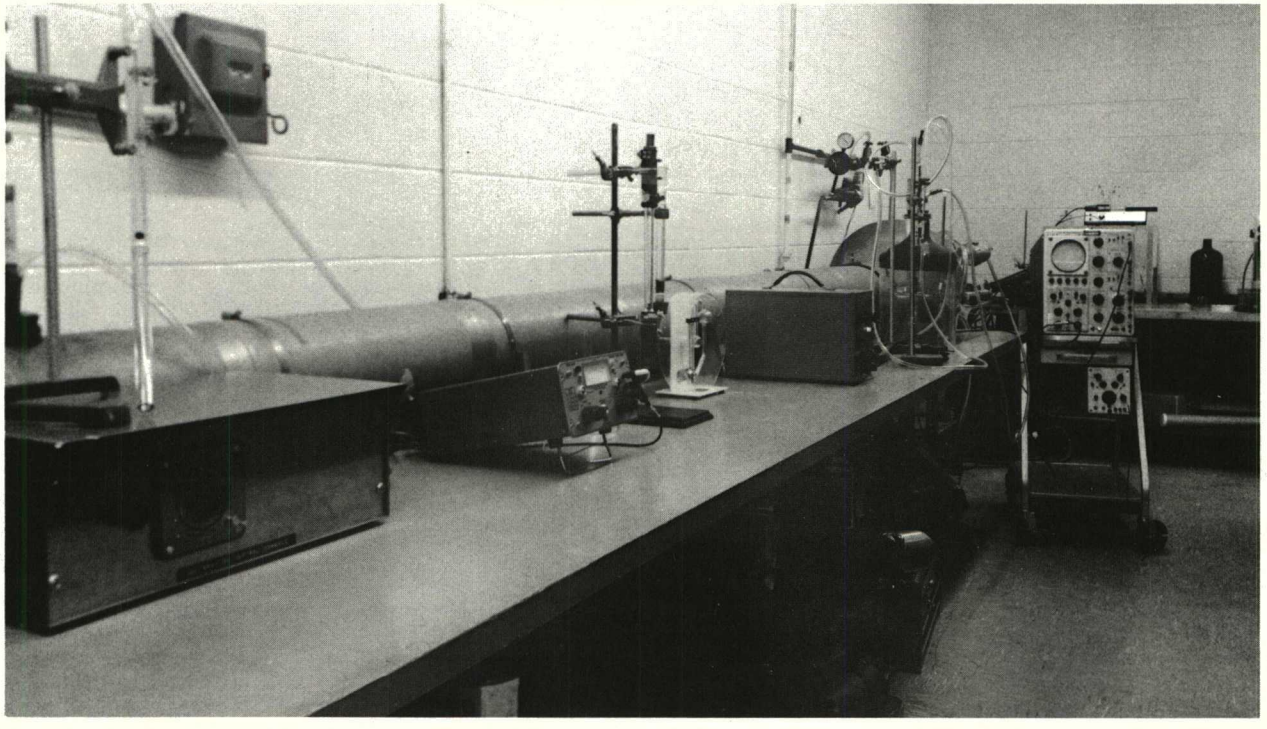


Figure III-14. Photograph of GCA/Technology Division Wind Tunnel.

measurement instrumentation. This facility is used extensively to evaluate pilot scale pollution control systems and to develop, calibrate, test, and evaluate particulate and gaseous measurement instrumentation for source and ambient measurements. In addition to the major equipment items enumerated in Table III-3, and briefly discussed in the following text, this laboratory has an extensive inventory of supporting equipment including such items as a wind tunnel, aerosol generators, electron equipment, filter holders, standard mechanical and electronic test and checkout gear, optical benches and optical measurement instrumentation, etc.

- Wright Dust Feeder--Mechanical redispersion of polydisperse aerosols is achieved by a shaving action with deagglomeration with compressed air. Such dusts as Arizona road dust (AC Fine Air Cleaner Test Dust), coal dust, rock dust, etc., are conveniently dispersed with a mass output in the range 1.5 mg/min to 100 mg/min to yield tunnel concentrations in the range 0.15 mg/m^3 to 10 mg/m^3.

- Spinning Disc Monodisperse Aerosol Generator--An air driven 1-inch diameter stainless steel disc can be driven up to 180,000 rpm to produce monodisperse aerosols by introducing a water/ethanol solution of methylene blue, fluorescein, iron oxide, or other soluble material onto the disc center, spinning off droplets of uniform size from which the water/ethanol solvent evaporates leaving solid spherical aerosol particles. Size ranges for solid particles are from approximately 1 to 15 μm with μ_g typically 1.10 or less; liquid droplets can also be produced in the size range of 8 to 200 μm.

- ERC Fluid Atomization Aerosol Generator--This device utilizes air-blast atomization and inertial impaction to produce submicron aerosols with a narrow size distribution. This device may be optionally employed to charge-neutralize the aerosol. A typcial application would be to generate methylene blue-fluorescein aersol amenable to fluormetric analysis. Monodisperse latex hydrosols (DOP) can also be conveniently dispersed in the size range of 0.1 μm to 2.0 μm.

- Dust Chamber--A 1-m^3 dust chamber is available to contain aerosols so that much higher concentrations can be generated than are attainable in the wind tunnel where

TABLE III-3. GCA/TECHNOLOGY DIVISION AEROSOL MEASUREMENT LABORATORY EQUIPMENT HOLDINGS

Item	Manufacturer and Model No.
Wind Tunnel	8 in. Diameter Test Tunnel
Wright Dust Feeder	Wright (England)
Spirometer	F. E. Wierderman--1.419 liters/cm
Optical Microscope	American Optical Model 10 Microstar
Fluorometer	Turner 110
Spinning Disc Aerosol Generator	Research Engineers, Ltd.
Fluid Atomization Aerosol Generator	ERC 7330
Laboratory Press	Carver
Electrostatic Voltmeter	Singer EDS-6
Strip Chart Recorder	Bausch & Lomb VOM 10
Meteorograph	Weather Measure M701
Digital Multimeter	Data Precision 2540
Wet Test Meter	Precision Scientific
Optical Comparator	Jones & Lawson Mod. PC
High Altitude Chamber	Standard Cabinet Company
3 Optical Stereo Viewing Microscopes	American Optical Spencer
Analytical Balance	Mettler Model H5
Thermo-Anemometer	Alnor
Analytical Balance	Mettler Model H15
Lock-in Amplifier	Princeton Applied Research Mod. HR-8
Stroboscope	Strobatic, Type 631-BL
Condensation Aerosol Generator	
Miscellaneous Electronic Equipment (Power supplies, oscilloscopes) Ovens, pumps	

typical flow-through is of the order of 10 m^3/min. With the Wright Dust Feeder, concentrations up to 200 mg/m^3 have been produced.

- TSI Fluidized-Bed Aerosol Generator--This dust generator is used for those aerosol instrumentation programs requiring stable and controllable levels of respirable dust. This device is used for the generation of coal dust, silica dust, etc., as required for the development and calibration of monitoring instruments.

- Optical Microscope--An American Optical Series 10 Microstar stereo microscope with a superior illuminator (Ortho-Illuminator) has objective lenses which include 5x, 10x, 20x, 40x 45x, as well as a 100x oil immersion lens. The microscope is also equipped with a phase condenser, phase telecope, and 40x phase objective so that phase microscopy may be performed for counting asbestos fibers. Additionally, a Polaroid camera is attached for photomicroscopy.

In addition, the aerosol laboratory instrumentation includes an extensive complement of temperature sensors, pressure and vacuum gages, flowmeters and hygrometers. Temperature sensors include general liquid-in-glass thermometers, thermistor sensors and a digital resistance thermometer. Pressure and vacuuum gages include both vertical and inclined U-tube manometers, several Magnahelic gages ranging down to 0.25 in. H_2O, well-type manometers, aneroid gages, barometers and a McLeod gage for high-vacuum measurements. Several complete sets of laboratory grade rotameters which are routinely calibrated with respect to a F. E. Wiederman spirometer are available for air and gas flow measurements.

3. Machine Shop

The machine shop (part of which is depicted in Figure III-15 located within GCA's Bedford facilities) is equipped with the necessary personnel and machine tools (Table III-4) necessary to fabricate the various components of the asbestos generation-sampling system. The shop is equipped with lathes, milling machines, drill presses, grinders and specialized machine attachments capable of performing custom, high quality machining. The

personnel who staff the shop have over 100 man-years of experience in specialty machining of apparatus and instruments.

4. Optics Laboratory

Figure III-16 shows the optical instrumentation laboratory dedicated to the development, testing and calibration of instruments and devices using visible, ultraviolet and infrared radiation. A complete optical bench with magnetic component support; a large optical comparator for precision measurements; microscopes; lasers; light detectors; and a large array of optical components such as lenses, windows, polarizers, gratings, prisms, mirrors, etc., are available. Surveying and detection equipment for radioactivity measurements and surveillance are also part of this laboratory. A Ph.D. physicist is assigned to the activities related to the Optics Laboratory.

5. Instrument Production Section

This section of the Instrumentation Department performs the fabrication activities that are used for the routine production of instrumentation for commercial sale. This section consists of several wire-persons and assemblers and electronic checkout and calibration technicians (Figure III-17).

D. COMPUTER FACILITIES

GCA/Technology Division routinely uses computer programming and data processing in support of contract work in a wide range of technical areas. Most of GCA's computer work is conducted on an IBM 3033, which services all divisions of GCA Corporation, nationwide. GCA/Technology Division programmers also have access to UNIVAC, CDC, DEC, and Honeywell facilities in nearby technical installations.

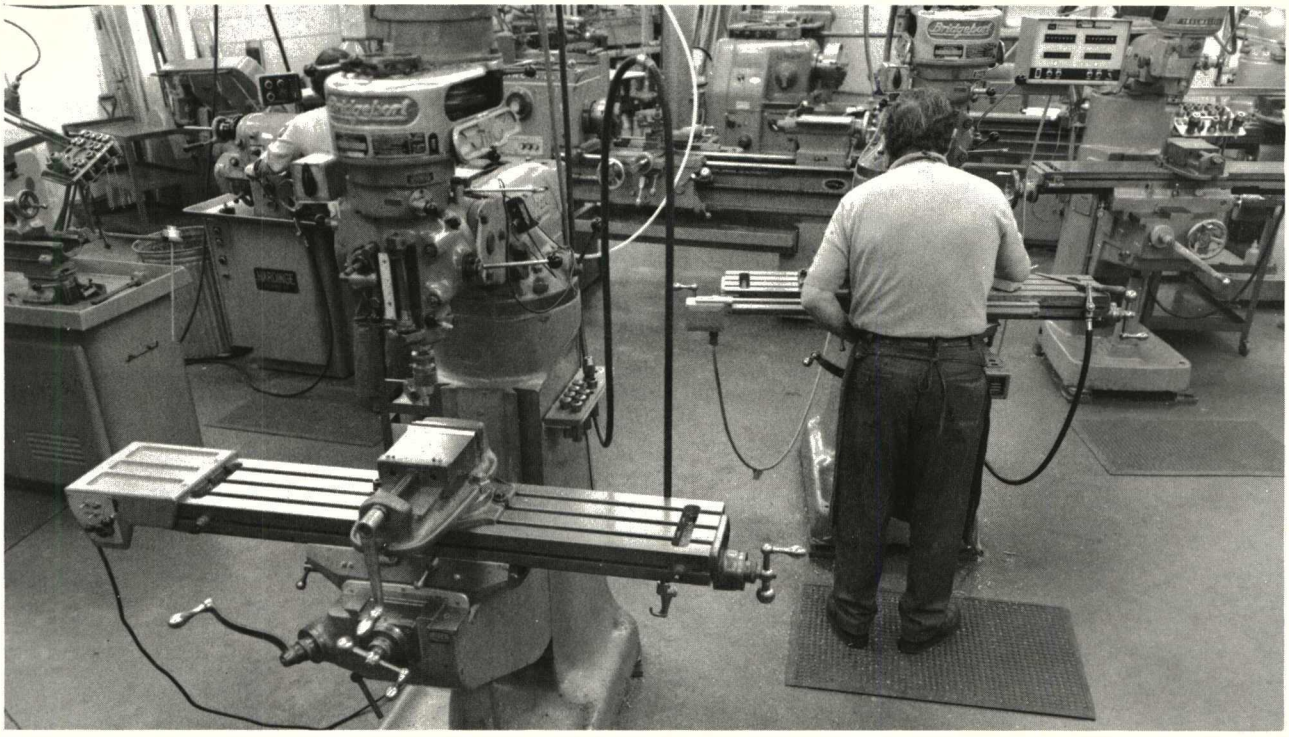
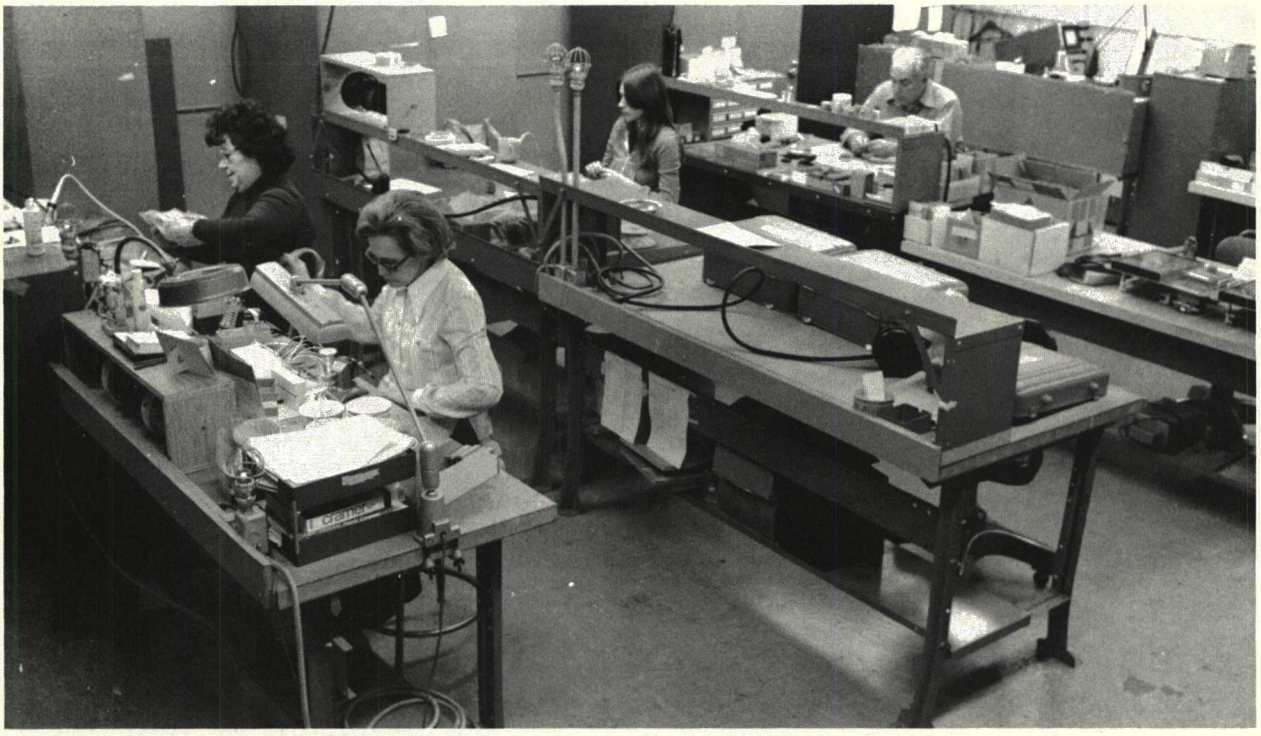


Figure III-15. View of GCA/Technology Division Machine Shop.

Figure III-16. View of the Optics Laboratory Facilities at GCA/Technology Division.

TABLE III-4. MECHANICAL FABRICATION AND MACHINE SHOP EQUIPMENT AVAILABLE AT GCA/TECHNOLOGY DIVISION

Item	Manufacturer	Model No.	Number
1. Equipment for Milling, Drilling, Cutting, Lathe Operations and Welding			
Miller	Bridgeport Machine	J91680	2
Miller	Cincinnati Milling Machine	6J2V5	2
Lathe	South Bend	CL8187	
Lathe	Hardinge	HLV	
Lathe	Cincinnati	42 inches	
Lathe	Okuma	2S	
Lathe	Hardinge	5C929C	
Sander	Rockwell	31-710	
Grinder	Cincinnati	CPTA	
Tool grinder	Hammond	D-6	
Drill press	Delta/Rockwell	126	
Drill press	Walker-Turner	65-000	
Tapping head	Ettco-Emerick	1B	
Surface grinder	Do-All	DH-612	
Arbor press	Drake	1-1/2 B	2
Heliarc welder	Miller	330 A/B	
Notcher	Di-Arco	1	
Cut-off machine	Do-All	223	
Band saw	Do-All	1612-1	
Shear	Peck, Stow & Welrox	152-J	
2. Miscellaneous Supporting Equipment for Accuracy Measurement			
Optical comparator	Jones & Lawson	PC 14A	
Digital Readout for Miller	Itek	DEM 15	
Granite surface plate	4 ft x 5 ft		
Various measuring and inspecting instruments such as calipers, height gauges, indicators, micrometers, rotary heads, etc.			



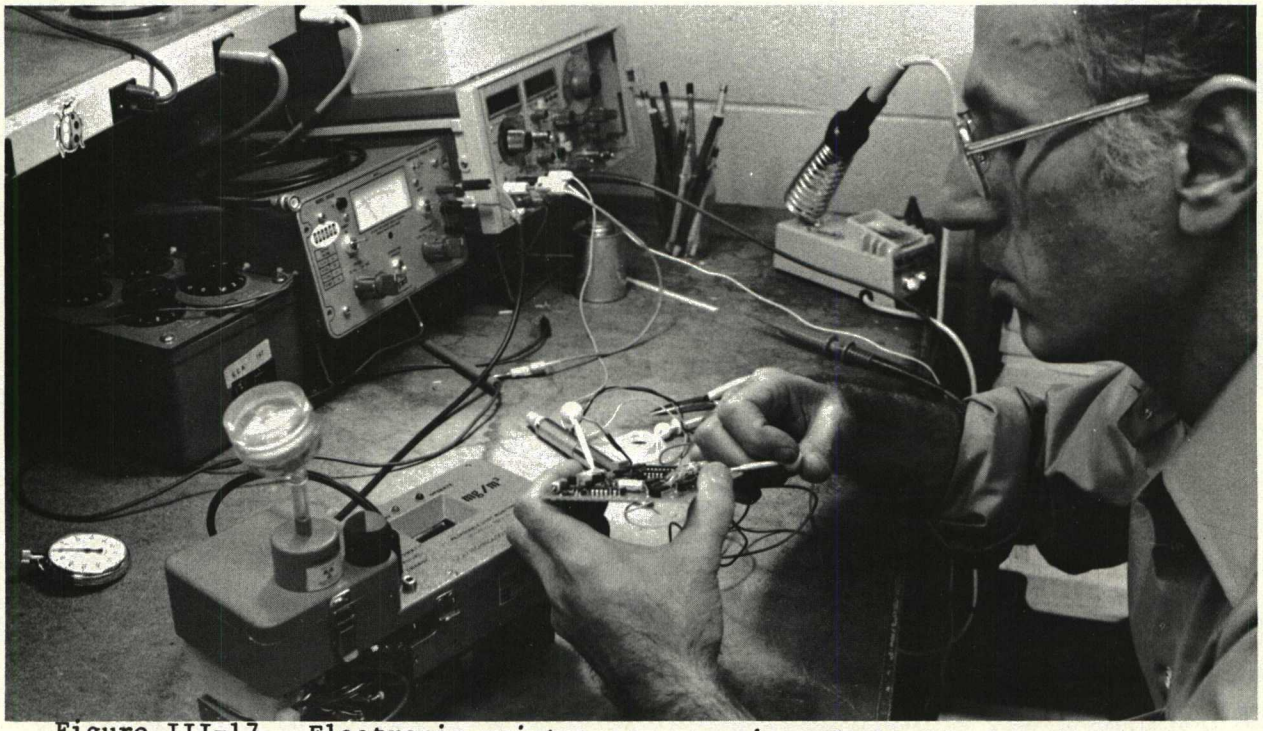


Figure III-17. Electronic maintenance, repair and troubleshooting facilities Available at GCA/Technology Division.

At each of these facilities, GCA programmers have access to, and familiarity with, a large library of standard statistical and analytical programs, including the BIOMED and SPSS statistical packages. GCA programmers have developed a multipurpose graphics package for displaying frequency distributions (on both log- and linear-probability scales), air and water quality data, and contour plots. GCA also maintains an extensive library of numerical integration, solution of ordinary and partial differential equations, function minimization, and regresssion analysis.

The GCA programming staff are particularly skilled in using scientific programming languages. FORTRAN and PL/1 are typically used for analytical purposes. EASYTRIEVE is used extensively for summarizing data and for producing reports in convenient formats.

A large portion of GCA's computing activities involves designing, testing, and implementing computer models that predict the transport of pollutants emitted from a variety of source configurations. The following is a partial list of modeling programs that have been used by GCA:

- Development of comprehensive air quality health effects data systems.
- The design of in-house pollutant data retrieval systems for use in environmental diffusion modeling studies.
- Provision of assistance and training to State and local agencies in the installation and operation of environmental data systems such as EIS/P&R and AQDHS-II.
- Documentation of the various retrieval, sorting, and reporting capabilities of the EPA AEROS system.

E. LIBRARY RESOURCES

The GCA/Technology Division library, shown in Figure III-18, is staffed with two professional librarians and an assistant. The library contains approximately 7,000 books, 1,600 bound periodicals, 10,000 reports, and subscribes to 300 current periodicals. The collection is strong in the areas of air and water pollution, solid waste management, analytical chemistry, energy, and transportation.

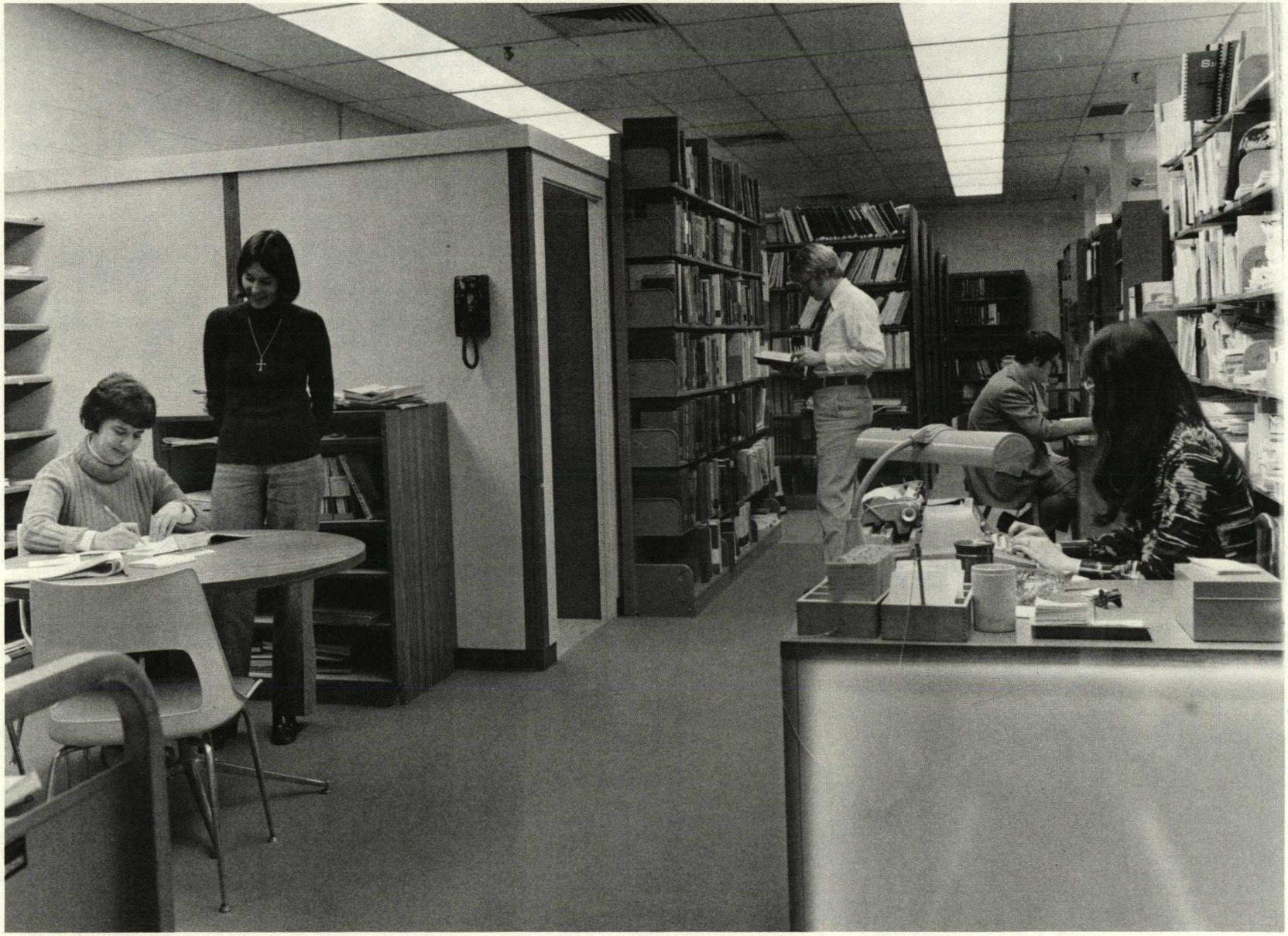


Figure III-18. GCA/Technology Division library.

The use of computerized literature searching is a vital component of all programs at GCA. Our literature searching section has in-house access to almost all commercially available data bases. We use the Lockheed, BRS, and SDC systems. We also subscribe to NERAC, the New England Research Application Center, which has access to files not available to the other data base vendors; e.g., Energy Research Abstracts, and we subscribe to the Chemical Information System (NIH-EPA), which has tie-ins with 66 data bases.

Our location in the Boston Metropolitan Area with its many universities provides GCA with ready access to numerous other collections, all within 30 minutes' travel time. We subscribe to the MIT Libraries Membership Plan for Industry through which we draw on the extensive resources of the MIT Libraries.

In addition, the Library maintains working relationships with other libraries: EPA Region I Library, Harvard University Libraries, Boston Public Library, and the U.S. AFCRL Library in Bedford. Other libraries that are available include those at Boston University, Brandeis University, Tufts University, and the University of Massachusetts.

Through its in-house collection and its access to the many other collections and services described above, library personnel are able to provide extensive literature searching services, including current awareness, and quick document delivery.

F. TECHNICAL PUBLICATIONS

GCA/Technology Division maintains a technical publications department (Figure III-19) staffed by two technical editors, eight technical typists, two technical illustrators, a printer, and a publications assistant. The department is equipped with a Wang 25 word processor with a 5-megabyte disk storage CPU, an Addressograph Multigraphics System and printer with a 104-station collator, which can print over 20,000 impressions per day (normal operation averages over 15,000 impressions per day), and the Visual Graphics POS-ONE Camera to provide rapidly available reductions of oversize materials. GCA is also equipped with a photographic laboratory, staffed by a professional

Figure III-19. Technical publications department.

photographer, which can be used for any photographic requirements that may arise during the course of a project. These personnel and equipment provide for rapid and efficient turnaround on the multitude of reports, proposals, and papers that enter the department daily.

SECTION IV
RESUMES

This section contains resumes of key GCA staff who are available to assume major technical and management responsibilities on hazardous waste enforcement support tasks.

Susan L. Bianchetti
Robert J. Bouchard
Robert M. Bradway
Mary Anne Chillingworth
David R. Cogley
James W. Davison
Paul F. Fennelly
Patrick J. Ford
Stephen E. Gronberg
Robert R. Hall
Thomas Hopper
Marilyn Hoyt
Pablo Huidobro
Gary Hunt
Robert Kindya
Nancy Krusell
Arlene Levin
Robert Bowley Lucas
Kenneth T. McGregor
Edward F. Jussler
Barbara M. Myatt
Thomas J. Nunno
Lester Y. Pilcher
Douglas R. Roeck
Howard F. Schiff
Charles W. Young

SUSAN L. BIANCHETTI

Professional Experience

Present Occupation: Geologist, Environmental Engineering Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Ms. Bianchetti's primary responsibilities include in-house analysis and evaluation of hazardous and toxic substances. This work includes product testing, sample analysis, and study of controls and substitutes for hazardous products. The test methods she uses include polarizing light microscopy, phase contrast microscopy, scanning and transmission electron microscopy, and X-ray diffraction.

Recently Ms. Bianchetti was involved in toxic and hazardous waste studies at Love Canal, New York. As Assistant Sample Bank Manager, her duties included sample collecting and processing and coordination with subcontractors. She was also responsible for set-up and control of the field data coding system and data verification.

Ms. Bianchetti's additional responsibilities at GCA include preparing guidelines for the analysis of asbestos; removing asbestos-containing material from school buildings, and preparing proposals for hazardous substance studies.

1979: Boston College. Ms. Bianchetti worked on the development of a computerized program dealing with the wave refraction pattern off the coast of Scituate, Massachusetts.

Education

B.S., Geology, Boston College, 1979
Journalism, Alfred University, 1973-1975

Professional Societies

Northeastern Association of Microscopists

SUSAN L. BIANCHETTI

Publications

Spooner, C. M., S. Bianchetti, and R. Bouchard. Asbestos Control Technology Assessment. U.S. EPA, October 1980.

ROBERT J. BOUCHARD

Professional Experience

Present Occupation: Geologist, Environmental Planning and Analysis Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Mr. Bouchard's primary responsibilities involve evaluating geologic data for use in environmental quality studies and hazardous waste disposal impacts. These studies include identifying toxic and hazardous substances and their effects on air and water quality. Recent projects include the hydrogeologic study of the Love Canal area, New York. Mr. Bouchard was responsible for coordinating the field activities of the geotechnical subcontractors. These activities included drillsite selection for ground water monitoring wells, sampling, modeling, and geophysical surveys to determine geologic structure as well as contaminant plume pathways. Other projects involved the supervision of drilling operations for a ground water study in Concord, Massachusetts. Also, as advisor to the City of Taunton, Massachusetts, Mr. Bouchard worked on the location of hazardous waste disposal sites.

Currently, Mr. Bouchard is conducting asbestos product testing for the EPA. These products are analyzed using both scanning and transmission electron microscopy, phase contrast, and polarized light microscopy to determine fiber size distribution for a comparison study of NIOSH and Stanton fibers.

1977-1978: Research Assistant, Weston Observatory, Concord Road, Weston, Massachusetts. The Narragansett Basin Coal Project involved the exploration for potential coal resources in southeastern Massachusetts and Rhode Island. Mr. Bouchard's duties in this investigation involved field mapping the Carboniferous Rhode Island Formation. In addition, he identified abandoned mining localities from literature searches and assisted in the production of area geologic maps and the selection of drillsites. Drillsite procurement also involved the legal, environmental, economic, and social factors required by the U.S. Bureau of Mines.

1975-1977: Editor/Indexer, GeoRef Division, American Geological Institute, 5205 Leesburg Pike, Falls Church, Virginia. Mr. Bouchard edited and indexed English and foreign language geological literature for input into the GeoRef data base. This data base is used in the publication of the Geological Society of America Bibliography and Index of Geology as well as custom computer searches. Other projects included the publication of a geological thesaurus and glossary.

1974-1975: Teaching Assistant, Department of Geology, Boston College, Chestnut Hill, Massachusetts. Mr. Bouchard's duties involved the preparation and instruction of laboratory courses in introductory geology. This included the preparation of thin sections for polarized light microscopic examination and the microscopic analysis

and classification of igneous and metamorphic rocks. Also, Mr. Bouchard taught seminars on related lecture topics. He also designed and constructed a flume for physical sedimentation experiments under a work-study program. Special studies were concentrated in the areas of regional volcanism of New England, Canada, and Iceland, including filed reconnaissance and petrographic analysis of volcanic rocks.

Education

M.S., Geology, Boston College, 1980
B.S., Modern Languages, Boston College, 1970

Professional Societies

Geological Society of America
Sigma Xi

ROBERT M. BRADWAY

Professional Experience

Present Occupation: Manager, Hazardous Waste Programs, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Mr. Bradway is responsible for overall technical and cost management of GCA's hazardous waste programs, including regulatory activities associated with RCRA as well as solving uncontrolled or abandoned waste site problems. This latter category includes site characterizations, the definition of geological and hydrological features, evaluation of practical remedial measures, preparation of detailed engineering specifications, selection and management of subcontractors when needed, and design and implementation of follow-up monitoring programs.

Mr. Bradway is currently the program manager for the nearly completed Love Canal Monitoring Program. This $5.4 million program, considered to be the most comprehensive environmental monitoring study ever attempted, required the management of 20 subcontractors in addition to the 25 GCA staff included. The program involved the sampling of soil, sediment, air, and water for volatiles, pesticides, and semivolatile organic compounds plus 14 metals. One hundred and seventy-eight observation wells were installed, and ground penetrating radar, electromagnetic induction, and resistivity were used to help define the underlying geologic features. Over 10,000 samples were collected with 350,000 data records being handled by the GCA data management system.

Formerly, Mr. Bradway was Manager of GCA's Environmental Measurements Department. He was responsible for design and implementation of monitoring networks and the chemical and physical analyses of liquid and solids and atmospheric gases, vapors, and aerosols. He was also responsible for the stationary source stack sampling services offered by GCA to industrial and governmental clients both in terms of compliance testing and evaluation of air pollution control devices. His responsibilities also included instrument development and calibration, data analysis, and report preparation.

Other recent projects have included the design and implementation of a high-volume sampler network in an effort to identify the source(s) responsible for the observed high suspended particulates in one section of Baltimore. He conducted similar programs in Moscow, Idaho, and Twin Falls, Idaho, as well as being involved in developing and maintaining several permanent gaseous and particulate monitoring networks.

MARY ANNE CHILLINGWORTH

Professional Experience

Present Occupation: Senior Scientist, Environmental Planning and Analysis Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Ms. Chillingworth is the GCA/Technology Division Safety Officer and Product Safety Administrator. She is currently managing a hazardous waste compliance program for a private client and has just completed managing the Industrial Waste Management Alternatives Assessment for the State of Illinois. This three-part study: (1) investigated the chemical and physical characteristics of industrial process wastes and grouped them by SIC codes, (2) investigated management alternatives for industrial wastes, and (3) assessed the feasibility/ applicability of management alternatives to groups of industrial wastes. She was the Safety Officer for the recently completed GCA Love Canal Monitoring program.

She recently managed a task for EPA to identify U.S. processors of asbestos fiber. In addition, she participated in developing environmentally acceptable recommendations for a private developer faced with toxic metal-contaminated soil on a building site. Ms. Chillingworth was a principal investigator in the Environmental Assessment of Coal-Fired Fluidized-Bed Combustion (FBC), responsible for developing multimedia environmental goals for selected pollutants and the assessment of health and ecological impacts of FBC emissions. She has been actively involved in other pollutant effects studies and helped organize GCA's analytical laboratory, including the sample bank and quality control measures. During her participation in an EPA program to chemically analyze conventional combustion emissions, she worked on modifications to the procedures manual. Ms. Chillingworth has participated in surveys of the fertilizer and boiler industries.

Ms. Chillingworth was the principal investigator in two Statewide hazardous waste surveys: Illinois and Massachusetts. In the Illinois study, she participated in organizing, conducting, and analyzing a mailing survey of more than 20,000 industrial facilities. For the Massachusetts survey, she conducted a telphone survey and compared these results with the data in the State's licensed hauler files.

1974-1976: Senior Research Associate, Resource Planning Associates, Inc., Cambridge, Massachusetts. Ms. Chillingworth's major responsibilities included planning analytical methodologies, conducting research, including interviews; analyzing environmental impacts and policy alternatives; interacting with clients; and submitting final reports. She was the team member specializing in water quality, public health, and energy conservation and management in a

multidisciplinary team on many projects, including environmental impact statements, areawide wastewater management studies, a pollution damage assessment model, an analysis of energy requirements for pollution control in the iron and steel industry, and various energy policy studies.

1972-1974: Graduate Assistant, UNC Wastewater Research Center, Capel Hill, North Carolina. Ms. Chillingworth performed bioassays to determine the toxicity of textile dyes to fish and algae and investigated the effectiveness of biological treatment in reducing dye toxicity.

Education

M.S.P.H., University of North Carolina School of Public Health, Department of Environmental Sciences and Engineering, 1974
B.S., Biology, Tufts University, 1970

Certification

Certified Industrial Hygienist in Training

Professional Societies

American Public Health Association
Massachusetts Public Health Association

DAVID R. COGLEY

Professional Experience

Present Occupation: Head, Health and Environmental Impacts Section, Environmental Planning and Analysis Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Dr. Cogley is currently directing a study to document and review toxic and hazardous air pollution emission sources in the Memphis metropolitan area. In addition, Dr. Cogley directed geotechnical investigations at Love Canal, including geophysical surveys, installation of monitoring wells, ground water modeling, and ground water sampling. Geophysical survey measurements were obtained using ground penetrating radar, electromagnetic induction conductivity, metal detectors and a magnetometer. One hundred and seventy-eight ground water monitoring wells were installed in unconsolidated materials and bedrock. Ground water modeling was used to assess flow in the shallow aquifer in unconsolidated materials, to assess flow in the bedrock aquifer, and to assess remedial measures effectiveness.

Previously, Dr. Cogley managed an asbestos life cycle study for EPA's Office of Pesticides and Toxic Substances, as well as a study of asbestos substitutes, a workshop on alternatives to asbestos products, and other asbestos sampling and measurement tasks. These studies involved analysis of exposure and risk to workers and the general public from the mining and milling of asbestos and its use in the production of asbestos products, the assessment of alternative risk reduction strategies and the availability of substitute products. Dr. Cogley also directed the sampling and chemical analysis of potentially contaminated ground water in the Town of Concord, Massachusetts. This project involved supervising well-drilling activities, obtaining water samples, and analyzing resultant data.

Dr. Cogley directed an assessment of industrial contamination of soil and ground water. Evidence of contamination was discovered during soil foundation investigations for a proposed 13-story commercial building. GCA/Technology Division investigated the problem using data from a comprehensive coring, trenching, and chemical analysis program to define the extent and nature of contamination. Analytical results, together with historical data and an analysis of regulatory requirements led to the definition of options for the disposal of soil required to be removed before pile driving and foundation work began. GCA personnel defined the concentrations, quantities, and ecological impacts of heavy metal present in the soil. Serving as liaison between the client and state authorities, GCA aided in the definition of disposal procedures for contaminated soil in line with State and Federal guidelines.

1974-1979: Program Manager, Environmental Studies Group, Walden Division of Abcor, Inc., Wilmington, Massachusetts. Dr. Cogley directed a

Department of Energy contract to prepare environmental impact statements for 11 steam-electric generating stations issued by ESECA Prohibition Orders. He also directed a study of environmental effects resulting from the disposal of toxic chemicals at a 25 square-mile military site over the past 35 years. The general approach consisted of defining environmental pathways, evaluating equilibrium constants for each step along each path, and evaluating the pollutant concentration required at the pollutant source to result in the receipt of a toxic dose by humans under various modes of exposure. Preliminary limit values were calculated for the allowable concentration of each pollutant in soil such that humans would not receive toxic doses of the compounds. As part of this study, Dr. Cogley prepared statistical analyses of chemical concentration data and bioassay data (for phytotoxins) that resulted from a soil coring program at the military site.

Dr. Cogely managed a project for sampling and analysis of trace levels of toxic pollutants in industrial laundry wastewaters. Composite samples of raw water, raw wastewaters, and treated effluent from manufacturing facilities were analyzed to differentiate toxic materials (EPA Priority Pollutants) present in the water supply, added during processing, and/or removed by wastewater treatment.

1965-1973: Chemist, Staff Scientist in Electrochemistry, Tyco Laboratories, Inc., Waltham, Massachusetts. Dr. Cogley participated in the development of an implantable heart pump and the prevention of stress corrosion cracking of high strength aluminum alloys. Other projects included the investigation of fluoride transition metal ionic equilibria in propylene carbonate; design of central composite factorial experimental plans for the evaluation of nickel-cadmium battery performance under normal and stress conditions; determination of the equilibria and kinetics of the rate-limiting steps of a process for the removal of nitrogen oxides from power plant flue gases; a study of factors involved in the attenuation of dissolved wastes by soils; and the design of a process for removing dissolved copper from desalinization plant effluent.

1964-1965: P.R. Mallory Company, Burlington, Massachusetts. Dr. Cogley worked on the electrochemistry of primary and secondary electrochemical cell systems.

Education

Ph.D., Physical Organic Chemistry, Brandeis University, 1970
A.B., Chemistry, Harvard College, 1964
M.S. Candidate, Water Resources (Ground Water Hydrology), Northeastern University, 1982

JAMES W. DAVISON

PROGRAM AREA MANAGER
WATER/WASTEWATER PROGRAMS

PRESENT--Program Area Manager for programs related to water resources, water treatment, and wastewater treatment. Responsibilities include client services, program development, technical consulting and Principal in Charge role on various projects.

EXPERIENCE SUMMARY

A total of twenty-five years experience in water/wastewater treatment and air pollution control.

Ten years in wastewater disposal and pollution control for a major pertroleum refinery. Conduct of laboratory and field surveys of waste disposal problems, including definitive studies of effluent quanity and quality, development of treatability and basic design data, definition of treatment requirements from stream data, technical supervision of wastewater plant start-up, and operation and training of operating personnel.

Project Manager responsibilities included more than thirty wastewater sampling and process development projects, including several multi-team assignments. Participated as Project Scientist in over sixty similar projects. Previous experience includes management of work assignments under several EPA contracts related to water pollution abatement.

FIELD OF COMPETENCE

Project Management

- Design and implementation of wastewater characterization studies
- Wastewater sampling surveys and monitoring programs
- Wastewater treatability studies including laboratory pilot scale biological systems
- Pilot plant design, operation, and evaluation
- Process development of design data for primary and secondary wastewater treatment
- Development of procedures for the collection and treatment of contaminated water at disposal sites

- Design and fabrication of test equipment; evaluation and development of sampling and analytical systems, procedures, and methods

- Conduct of wastewater sampling seminars

Operations

- Wastewater treatment plant start-up and trouble shooting for municipal and industrial facilities

- Treatment plant operator training

1977 to 1981--Vice President Operations for York Research Corporation, a Stamford based environmental consultant firm. Position accountability included technical, administrative and financial responsibility for all air, water, and hazardous waste programs.

1966 to 1977--Roy F. Weston Inc., West Chester, PA. Progressed through several levels of technical and management positions during the eleven years tenure with this environmental consultant and design organization.

EDUCATION

Pennsylvania State University, B.S., Chemistry

Pennsylvania State University, Petroleum Engineering

PROFESSIONAL AFFILIATIONS

Water Pollution Control Federation

American Society for Testing and Materials

Air Pollution Control Association

The following projects are pertinent experience that Mr. Davison has had related to treatability studies and pilot plant operation for the evaluation of the performance of air stripping and carbon absorption treatment of wastewater:

- Kingman Lake Project--Washington, D.C.--A conceptual engineering study concerning the reclaimation of combined sewer overflows and the utilization of the treated water was conducted for the FWOA Department of Interior. Effluent from a multimedia filter was pumped through an activated carbon column pilot unit. Pressure drop and removal efficiencies of various organics were evaluated. Continuous monitoring of total carbon concentration was accomplished at eight sample points on the columns.

- National Starch and Chemical Corporation--Meredosia, IL--Onsite treatability studies were conducted on the wastewaters from this facility producing polyvinyl acetate polymers. The scope and objectives of the study included the evaluation of the feasibility of activated carbon treatment. A series of activated carbon isotherms provided data to conclude that activated carbon treatment was not a satisfactory process for the removal of specified organic loading from the wastewater.

- Hercules Inc. (ICI)--Wilmington, DE--Hercules, Inc. at their Wilmington plant undertook laboratory scale production studies of Herbon and Perathion with the generation of undesirable wastewaters. Since the wastewater was determined to be toxic to biological organisms and contained high concentration of ammonia, it was decided to investigate physically stripping the ammonia from the wastewater after Ph adjustment. A bench scale pilot unit was designed to maintain temperature and vacuum during the air purges. Ammonia removal was measured by means of acid scrubbers.

- ICI America--Dighton, MA--The resulting wastewater from this dye manufacturing facility was highly colored and discharged to the Taunton River. As part of the pretreatment prior to biological secondary treatment, an attempt was made to reduce the color concentration by various means including carbon adsorption. Laboratory treatability studies comparing lime treatment versus activated carbon showed that activated carbon treatment was not economically viable.

- Elkland Tannery--PA--As a result of over 80 years of operation as a tannery, the abandoned Elkland Leather Company facilities contained substantial amounts of residual materials, including wastewater, and sludges. The Pennsylvania Department of

Environmental Resources contracted to evaluate the waste mateials on the premises and to establish an abatement program. One of the alternatives recommended for treatment of the wastewaters included filtration followed by carbon adsorption for removal of suspended solids, organic compounds, and color. This alternate selection was preceded by appropriate pilot studies utilizing granulated carbon absorption in a column series.

- FMC Corporation--South Charleston, WVA--FMC Corporation operates a chlorinated dry bleach plant at the South Charleston facilities. A study was conducted to evaluate various treatment processes to enable FMC to meet the wastewater discharge criteria outlined in the plant's NPDES permit. Pretreatment requirements prior to disposal of the wastewater to a regional industrial waste treatment facility (an alternative to direct discharge) involved studies including air stripping for removal of ammonia and chlorine.

PAUL F. FENNELLY

Professional Experience

Present Occupation: Group Scientist and Manager, Environmental Measurements Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. As Manager of the Environmental Measurements Department, Dr. Fennelly is responsible for all field measurement programs within GCA. This includes continuous emission monitoring, source testing, wastewater, ambient air and solid waste sampling. Currently he is managing several GCA projects aimed at verifying destruction efficiency of PCB's when co-fired with conventional fuels in boilers. Dr. Fennelly currently directs GCA's 4-year Environmental Assessment/Systems Analysis Program on Fluidized-Bed Combustion for the U.S Environmental Protection Agency. This program involves field testing, process engineering, control technology evaluations, bioassay analyses, and environmental health effects assessments. The ultimate aim of the project is to ensure that EPA Program Offices have a data base sufficient to develop or revise pollution standards in conjunction with national energy policy.

Dr. Fennelly is also currently Program Manager for a GCA contract with the EPA to revise the Incinerator Air Pollution Control Code for the State of New Jersey. The objective of the program is to ensure the adequacy of the code in its coverage of hazardous emissions such as organics, total hydrocarbons, phosphates, sulfates, and trace metals.

Previously, as Staff Scientist in the Environmental Engineering Department, Dr. Fennelly provided technical direction on the following projects: Massachusetts Hazardous Waste Survey, in which types, quantities, and disposal options for hazardous waste materials in Massachusetts were identified; Investigation of Air Quality in the Vicinity of a Fiberglass Manufacturing Plant, in which high levels of formaldehyde, phenol, and fiberglass were inventoried and then evaluated in conjunction with health effects data; Pollution Control Measures for Secondary Aluminum Smelters, in which a strategy was developed for upgrading pollution control equipment and operating procedures for a smelter in the Midwest that was the object of numerous complaints about haze and odor formation; Improved Use of Waste Oil in Massachusetts, in which strategies were developed for better recovery and rerefining; preparation of a Handbook on Opacity Measurements, in which detailed comparisons will be made between visual opacity measurements and transmissometer data; preparation of a capsule report on Use of Fabric Filters in the Electric Utility Industry for EPA's Office of Technology Transfer; Screening Study of the Need for Standards of Performance for Industrial-Sized Boilers, in which the emission reduction of

NO_x, SO_2, particulates, and CO achievable by best available control technology in the period 1975-1985 were identified; Preliminary Environmental Assessment of Coal-Fired Fluidized-Bed Combustion, in which emissions estimates were developed for various classes of organic compounds and trace metals based on simple thermodynamic and kinetic models; Formation of Atmospheric Particulates, which consisted of a detailed review of the photochemistry and kinetics involved in the formation of secondary particulates such as sulfates, which defined environmental assessment programs related to new energy systems including methodologies for waste stream monitoring and pollutant identification.

1973-1974: Physical Chemist, AeroChem Research Laboratories, Inc., Princeton, New Jersey. Dr. Fennelly was involved in research and development of techniques for monitoring atmospheric pollutants. Specific projects included fluorescence detection of SO_2 for use as a continuous in-stack monitoring technique, mass spectrometric measurement of SF_6 and freons, chemiluminescence detection of O_3 and NO_x, and chemiionization reactions of potassium atoms. Dr. Fennelly was also involved in formulating a research program to investigate basic chemistry of coal gasification and combustion.

1972-1973: Researcher and University Instructor, Centre for Research in Experimental Space Science, York University, Toronto, Ontario. Dr. Fennelly worked on a research program using high pressure mass spectrometry and fast flow techniques to measure rate constants of ions and free radicals with atmospheric gases. Results were applicable to atmospheric chemistry, the chemistry of flames, and basic thermochemistry. Dr. Fennelly also taught a course in the Structure of Matter as an instructor in the Interdisciplinary Science Program.

1969-1972: Teaching Fellow, Department of Chemistry, Brandeis University, Waltham, Massachusetts. Dr. Fennelly's teaching duties dealt with an undergraduate physical chemistry laboratory course in which he lectured, designed and supervised laboratory experiments. He was also responsible for revision of course curriculum.

Education

Ph.D., Physical Chemistry, Brandeis University, Waltham, Massachusetts, 1972

Thesis: Investigation of Ion-Molecule Reactions in the Gas Phase using a Tandem Mass Spectrometer

B.S., Chemistry, Villanova University, Villanova, Pennsylvania, 1967

Honors

Visiting Lecturer, Air Pollution Science, University of Lowell, 1977, 1980, 1981
National Research Council of Canada Post-doctoral Fellowship, 1972-1973
National Science Foundation Traineeship, 1968-1969
Brandeis University Fellowship, 1967-1972
Villanova Merck Award, 1967

Professional Societies

American Chemical Society
Air Pollution Control Association

Publications

Thirty-one publications and presentations on topics including fluidized-bed combustion, atmospheric particulates, hazardous waste management, mass spectrometry, ion-molecule chemistry, SO_2 detection, and chemiionization

PATRICK J. FORD

Professional Experience

Present Occupation: Staff Scientist, and Head of Special Studies Section, Environmental Measurements Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. He is responsible for the design and implementation of air quality studies relating to gas chromatographic analysis, volatile organic compounds (VOC) and fugitive emissions. He is also responsible for water and wastewater sampling programs offered by GCA/Technology Division to industrial and government clients. His duties also include instrument maintenance and calibration, data reduction and analysis, and report and proposal preparation.

Mr. Ford is currently involved in a program to determine the effectiveness of the California South Coast Air Quality Management District's (SCAQMD) Rule 466.1. This rule requires refineries to conduct a screening and maintenance program designed to reduce fugitive hydrocarbon emissions from valves and flanges. In addition to this phase of the program, screening data were also collected on pumps and compressors at the source and at distances from the source in order to develop concentration with distance relationships. Prior to this, Mr. Ford was involved in a support task to an outside contractor in which volatile organics, e.g., benzene, chlorobenzene, and toluene, were characterized by approved gas chromatography techniques.

1978-1979: Scientist, Air Quality Section, Betz-Converse-Murdoch, Inc. Mr. Ford gained experience in many aspects of air quality monitoring including proposal preparations, pretest surveys, project and field coordination, laboratory analyses, and report preparation. He was involved in sampling programs for various pollutants including H_2S, SO_2, NO_x, CO, hydrocarbons, and particulate emissions. He participated in sampling programs on sources such as: sinter plants, coke oven stacks, power boilers, lime kilns, smelt tanks, blast furnaces, fugitive emissions in a cast house, food processing facilities, hooded quench car systems for coke oven "pushing" emissions, and incinerators. In addition, he was involved in a large-scale wastewater characterization and treatment program conducted at a major steel producing facility.

1976-1978: Sales Engineer, Free-Col Division. Mr. Ford was involved in marketing of environmental laboratory services in the air and water quality fields. He gained experience in source sampling, industrial hygiene surveys, and air and water analysis techniques.

Patrick J. Ford (Continued)

Education

M.P.H., Environmental Health, University of Pittsburgh Graduate School of Public Health, 1975
B.S., Biology, Bethany College, 1974

Professional Societies

Air Pollution Control Association

STEPHEN E. GRONBERG

Professional Experience

Present Occupation: Senior Scientist, Environmental Measurements Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Mr. Gronberg's primary responsibilities include stack and ambient air sampling with subsequent field analysis by gas chromatography and other methods. Mr. Gronberg is also responsible for EPA Level I environmental assessment sampling and analysis of air and water quality, inhouse laboratory analysis, equipment fabrication and calibration, data analysis, and observation of source tests for Regions I and VI of the Environmental Protection Agency.

Mr. Gronberg is the task leader of field operations for the EPA Inhalable Particulate Emissions project, which involves determining particle size distribution using instack cyclones and other EPA procedures.

He was also involved in the baghouse evaluation study conducted on a 360-MW coal-fired steam generator located at the Southestern Public Service Company's Harrington Station. The study included: the determination of total particulate collection efficiency of the baghouse; particle size determinations and fractional collection efficiency of the baghouse by instack impactors, condensation nuclei counters and electro-optical counters. The inorganic and organic gaseous components of the sample stream were also determined.

1975-1977: Water Pollution Control Engineer, Systems Engineering and Manufacturing Corporation, Stoughton, Massachusetts. Mr. Gronberg was responsible for the design, manufacture, installation, and start-up of automated metal finishing wastewater treatment systems. Typical duties included proposal, engineering report, quotation and instruction manual writing; equipment specification and design detailing; customer service; and interfacing sales with manufacturing, management, and drafting departments. He was also responsible for onsite calibration of equipment and instruction of operating personnel. He also worked as a laboratory technician on the development of low pressure/high velocity membrane filtration systems. His duties included membrane fabrication, treatability testing, and pilot-plant studies.

1973-1975: Laboratory Technician, Harold Chemical Products, Danvers, Massachusetts. Mr. Gronberg was involved in quality control and the formulation and packaging of various industrial and trade coatings. His duties included general bench testing, qualitative infrared and gas chromatographic analysis, and maintenance of computerized inventory control system.

Education

B.S., Chemistry, Lowell Technological Institute, 1975

ROBERT R. HALL

Professional Experience

Present Occupation: Section Manager, Chemical Processes Section, Environmental Engineering Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Mr. Hall is currently assistant program manager for GCA's Environmental Assessment/Systems Analysis of the Fluidized-Bed Combustion Process. His activities involve collecting and evaluating comprehensive emission test data, including inorganic and organic chemical analyses and biological tests; air, water, and solid waste control technology assessment; and standard support activities for EPA Program Offices.

Recently Mr. Hall acted as lead technical investigator on a program to revise the Incinerator Air Pollution Code for the State of New Jersey. The investigation required comprehensive technical and engineering review of current incinerator technology with respect to such parameters as operating temperature, dwell time, firing techniques, supplemental fuels, heat recovery, and other factors. Incinerators of all types were evaluated, including liquid injection, fluidized-bed, multiple hearth, rotary kiln, catalytic, molten salt, pryrolysis, and wet oxidation units.

Previously, Mr. Hall was task manager for several projects, including a study to determine the cost and technical feasibility of complying with proposed SO_2 regulations for Ohio, a contract to assess the techniques for reducing point and fugitive particulate emissions in selected nonattainment areas, and tasks to prepare draft standard support and environmental impact statements for new sources in the urea and ammonium nitrate industry. He has also managed several tasks related to vinyl chloride manufacturing and grain processing. In addition, Mr. Hall has acted as principal investigator for a study of the mass emission rate and particle size distribution of coke pushing emissions, a preliminary emissions assessment of air, water, and solid waste pollutants from conventional combustion systems, and the development and operation of a mobile fabric filter system.

1970–1973: Chemical Engineer, Harvard School of Public Health, Environmental Health Science Department. Mr. Hall gained experience in filter testing aerosol sampling techniques and particle sizing. He originated, conducted, and evaluated experiments involving the filtration and cooling of sodium in nitrogen aerosols. He also gained experience in the use of radioisotope tracers and the design of charcoal beds for absorption of radioactive xenon and krypton.

Robert R. Hall (Continued)

1969-1970: Process Development Engineer, W. R. Grace and Company, Polymer and Chemicals Division. Mr. Hall was responsible for scale-up of new polyvinylacetate products from research to commercial plant production. This scale-up involved following research, planning and directing pilot-plant experiments, and planning and supervising plant trials. He completed a scale-up of a new latex for an outdoor paint and also participated in the start-up of a new polyvinylacetate production facility.

1968-1969: Production Engineer Trainee, Allied Chemical Corporation. At this plant, which produces chlorine, caustic soda, and chloromethane, Mr. Hall's work involved training projects and reports in all phases of plant operation. He also performed troubleshooting projects on chlorine cells, adsorption towers, and low temperature methane-ethane distillation.

Education

B.S., Chemical Engineering, Lehigh University, Bethlehem, Pennsylvania, 1968

Professional Societies

American Institute of Chemical Engineers
Air Pollution Control Association

THOMAS HOPPER

Professional Experience

Present Occupation: Manager, Environmental Engineering Department, GCA Corporation, GCA/Technology Division, Bedford, Massachusetts. Mr. Hopper directs the efforts of 35 staff engineers and scientists relative to environmental pollution control, process evaluation and assessment, industrial studies and plant surveys, and source compliance determinations. Mr. Hopper has overall Divisional responsiblility for the management, technical and budgetary content, planning, scheduling, and execution of all environmental projects in the Enforcement Area, and in addition Mr. Hopper manages the Multidisciplinary, Quick-Response Technical Services contract for the Industrial Environmental Research Laboratory at Research Triangle Park, North Carolina. In this capacity, Mr. Hopper is responsible for providing resolution of any technical/management problems that may occur during the conduct of projects in these program areas. He reports directly to Dr. Leonard M. Seale, General Manager of GCA/Technology Division.

1977-1978: Chief, Permits Development Section, United States Environmental Protection Agency, Region I, Boston, Massachusetts. Mr. Hopper supervised a staff of 15 engineers and scientists responsible for the development and issuance of NPDES permits, ocean dumping permits, offshore oil and gas extraction activities, the biological/environmental impact review for proposed dredge and fill permits, coordination activity for Coastal Zone Management, consistency determinations, and power plant thermal discharge variance determinations. He also dealt with permit development activities for the Seabrook Nuclear Power Station.

1976-1977: Chief, Air Compliance Section, United States Environmental Protection Agency, Region I, Boston, Massachusetts. Mr. Hopper supervised a professional staff of eight, responsible for ensuring that all sources of air pollution of the six New England States comply with applicable State and Federal regulations. He was responsible for establishing, implementing, and coordinating procedures and strategies for Regional Air Compliance Programs regarding field inspections, stack and ambient sampling programs, contractor utilization, and enforcement case preparation, including civil proceedings.

1973-1976: Senior Program Manager, TRC--The Research Corporation of New England, Wethersfield, Connecticut. Mr. Hopper was responsible for managing and conducting multimedia environmental projects for industrial, utility, and government clients. He directed multidisciplinary teams in the areas of stack and effluent sampling, diffusion modeling, environmental impact assessment, air pollution control technology, and wastewater treatment. He was a program manager for a major EPA contract to determine nationwide

impact of NSPS. He gained knowledge in the areas of opacity determinations, measurement of toxic discharges, industrial emission surveys, supplementary control systems, pollution control at kraft pulp mills, diffusion modeling, FGD systems, and odor source evaluations.

1964-1973: Senior Experimental Engineer, Pratt and Whitney Aircraft, East Hartford, Connecticut. Mr. Hopper's responsibilities encompassed the design, fabrication, testing and analysis of advanced jet engine combustion systems. He developed a technique using sophisticated electronics/computers to measure pollutant levels in engine environments. He also managed NO_x and smoke reduction programs.

Education

B.S., Chemical Engineering, Worcester Polytechnic Institute, 1964

Professional Licenses

Professional Engineer, Connecticut

THOMAS HOPPER

Publications

Development of Effective Incineration Processes for Toxic Organic Air Pollutants. Presented at 70th Annual APCA Meeting, Toronto, Ontario, Canada, 1977.

Municipal Incinerator Enforcement Manual. EPA-340/1-76-013, January 1977.

Impact of New Source Performance Standards on 1985 Nationwide Emissions From Stationary Sources. EPA-450/3-76-017, 018, 019, 020, April 1977.

Analysis of the Excess Emission Problem Associated with the Operation and Maintenance of Air Pollution Control Systems. Presented at the Northeast Altantic International Section, APCA Meeting, October 10, 1979.

MARILYN HOYT

Professional Experience

Present Occupation: Environmental Scientist, Laboratory Analysis Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Ms. Hoyt is responsible for gas chromatographic/mass spectral analyses of organic pollutants in environmental samples. In recent work, Ms. Hoyt has identified components of mutagenic mixtures from several combustion sources. SHe has also analyzed the base-neutral and acid extractable chemicals from a hazardous waste site and identified major pollutants present. Ms. Hoyt used GC/MS analysis of air samples from an industrial plant to identify volatile organics present.

1979-1981: Research Assistant, University of Lowell, Lowell, Massachusetts. Ms. Hoyt performed research on a grant from Harvard School of Public Health to analyze volatile materials released in the meat wrapping process in the grocery industry. Ms. Hoyt participated in the design of a laboratory system to model the workplace and performed the gas chromatographic/mass spectral analyses of the occupational pollutants involved. The GC/MS system was based on a Varian/MAT112 equipped with a Varian 3700 GC and CDS trapping concentrator. She used capillary as well as packed columns.

1978-1979: Teaching Assistant. University of Lowell. Ms. Hoyt taught a laboratory program for a chemistry/biochemistry course for nurses.

1965: Research Assistant, Battelle Memorial Institute, Columbus, Ohio. Ms. Hoyt worked in synthetic polymer chemistry on an NIH project to develop membranes for the artificial kidney.

Education

M.S., Polymeric Chemistry, University of Lowell, Lowell, Massachusetts, 1981

B.S., High Honors, Chemistry, Denison University, Granville, Ohio, 1965

Honors

Phi Beta Kappa

Professional Societies

American Chemical Society, Polymer Chemistry Division

PABLO HUIDOBRO

Professional Experience

Present Occupation: Senior Scientist, Laboratory Analysis Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Mr. Huidobro is project member in the Asbestos Analysis Group and is responsible for the analysis of laboratory samples for content of asbestos and other hazardous and toxic substances and for analyzing high volume filters and membrane filters according to NIOSH methodology. These analyses are performed using the polarizing microscope, X-Ray Diffractometer, phase-contrast microscope and electron microscope (SEM and TEM). His responsibilities include interpreting results and preparing written reports. He is also responsible for assessing asbestos hazards in buildings and in the environment, consulting on several cases requiring identification of asbestos in buildings, and determining control options to minimize or eliminate an asbestos exposure hazard.

1979-1980: Geologist, Coastal Geotechnical Associates, Inc., Marblehead, Massachusetts. Mr. Huidobro's duties involved generating proposals and managing contracts with both governmental and private sector entities.

He participated as project manager in a contract with the Commonwealth of Massachusetts to carry out an in-depth study on ground water percolation testing, seasonal variability of ground water levels, and state-of-the-art of onsite "package" sewage treatment plants. The results of this study are being used by the Governor's Office of Economic Development as a guide for possible revisions of the regulations that affect the installation of waste disposal systems in Massachusetts.

Under subcontract for Energy Resources Corporation, Cambridge, Massachusetts, Mr. Huidobro carried out mechanical analysis and total organic carbon analysis on several hundred marine sediment samples. This study was part of an extensive survey that covered the Atlantic Coast of the United States.

He was also Project Coordinator for a Massachusetts Disaster Recovery Team contracted to evaluate the damage suffered by coastal structures under severe storm conditions during the "Blizzard of '78." His responsibilities included designing a scheme for the field work and following it to completion. This work included a comparative analysis of the effectiveness of coastal environment throughout that time. He was also responsible for processing and interpreting both historical and field data.

1978: Teaching Assistant, Department of Geology and Geophysics, Boston College, Chestnut Hill, Massachusetts. Mr. Huidobro's duties involved preparing and instrucing the laboratory component of a course in Sedimentary Techniques. This included the set-up and instruction on the use of the equipment used in all phases of the analysis of sediments in the laboratory, such as sample preparation, mass properties, textural analysis, grain size determination by sieving and settling, mineral separation and identification, petrographic and X-ray diffraction analyses, organic carbon and carbonate content, porosity, statistical analysis, and interpretation of depositional environment. Special studies were concentrated in the areas of petrological variations in continental shelf sediments off Massachusetts Bay.

Education

M.S., Geology, Boston College, 1980
B.S., Geology and Geophysics, Boston College, 1973

PABLO HUIDOBRO

Publications

Evaluation of Exposure Potential for Asbestos at the Damon Elementary School, Limestone, Maine. GCA-TR-81-13-G. 1981.

Sprayed-on Asbestos Material at the Maple Avenue School in Goffstown, New Hampshire. Final Report. GCA No. 7-411-01. 1981.

The Effect of Multiple Coastal Structures at Selected Massachusetts Sites. Geol. Soc. America Abst., 12. (With Benno M. Brenninkmeyer and Lydia J. Wood.)

The Effectiveness of Coastal Structures in Selected Massachusetts Sites. Fifth Annual Conference, The Coastal Society, 1979.

Evaluation of Coastal Structures in Marshfield, Plymouth, and Martha's Vineyard, Massachusetts. Department of Geology and Geophysics, Boston College Tech Report 79-1, 156 p. (with Benno M. Brenninkmeyer and Lydia J. Wood.), 1979.

GARY T. HUNT

Professional Experience

Present Occupation: Staff Scientist, Head, Organic Section, Laboratory Analysis Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Mr. Hunt's duties include management and supervision of the Organic Analysis Laboratory. In this capacity, he also provides technical inputs to a number of hazardous waste characterization studies. Such studies include applications of state-of-the-art analytical techniques to organic analyses of hazardous wastes, industrial effluents, sediments, ground waters, and related media. He currently serves as the analytical task manager in an investigation of the chemical properties of fluidized-bed combustion source emissions. Special interests while at GCA have included PCB incineration studies, protocols for the sampling and analysis of hazardous emissions and the incidence of volatile organics in ground and surface water in the New England area. Research interests have included the application of chromatographic techniques (LC, HPLC, GC, TLC) in the characterization of environmental toxicants. He recently completed a manuscript on application of thin-layer chromatographic techniques to water pollution analyses.

1976-1977: Research Assistant, II, Chemistry Department, Woods Hole Oceanographic Institute, Woods Hole, Massachusetts. Mr. Hunt characterized trace organics in estuarine and marine systems with special emphasis on the incidence of petroleum hydrocarbons and fatty acids in ocean sediments. Additional duties included organizing and participating in marine research expeditions.

1974-1976: Research Intern, Department of Environmental Sciences, Rutgers University, New Brunswick, New Jersey. Mr. Hunt performed trace organic analysis in aquatic systems with procedural development related to the isolation and identification of phenolics in natural water systems. He performed a reconnaissance survey of phenolic compounds in the Delaware estuary, conducted a pilot study on the occurrences of PCBs in the New Jersey fish population, and served as an advisor to the Phenol Committee of the 15th edition of Standard Methods for the Analysis of Water and Wastewater.

Education

M.S., Environmental Science, Rutgers University, New Brunswick, New Jersey, 1977
B.S., Chemistry, Villanova University, 1974

Gary T. Hunt (Continued)

Professional Societies

Sigma Xi
American Chemical Society

Publications

Eight publications in environmental chemistry

ROBERT J. KINDYA

Professional Experience

Present Occupation: Staff Scientist, Health and Environmental Impact Section, Environmental Planning and Analysis Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Mr. Kindya is responsible for assessing health and environmental effects of advanced energy technology, especially fluidized-bed combustion of coal. He is an instrumental part of the group at GCA conducting the complete Environmental Assessment of fluidized-bed combustion for the U.S. Environmental Protection Agency. He is also responsible for analysis and interpretation of biological and ecological test data. Mr. Kindya has been active in Standard Support activities for EPA project offices and has also prepared Technical Memoranda for the EPA Office of Radiation Programs, Office of Solid Waste, and Office of Toxic Substances.

In conjunction with the GCA Analytical Laboratory and Oak Ridge National Laboratory, Mr. Kindya has reviewed and assessed the RCRA Extraction Procedure (EP) and the recommended biological tests to be conducted for identification of hazardous waste on solid waste materials from energy proceses, especially coal combustion.

Mr. Kindya has also been active in environmental goals development. As Task Coordinator, he was responsible for the assessment of the toxicity and impact on aquatic life of effluent from industrial facilities discharging into the Chesapeake Bay Basin. He has also developed and adapted models to estimate multimedia environmental goals for nonchemical factors such as ionizing and non-ionizing radiation and land and water use.

1978: Consultant to the Department of Chemistry, Brookhaven National Laboratory, Upton, New York. Mr. Kindya performed biological assays of γ-irradiated samples to discern actions of free radicals on mammalian enzymic systems *in vitro*. He was responsible for analyzing data generated by this experimentation, interpreting results, and planning subsequent investigative efforts.

1972-1978: Biochemist, State University of New York, Downstate Medical Center, Department of Biochemistry, Brooklyn, New York. Mr. Kindya was engaged in basic biochemical/environmental research. He studied effects of oxidant air pollutants, especially ozone, on biological systems. He was especially interested in the interaction of ozone with cell membrane components (e.g., phospholipids) and membrane enzyme systems, specifically those of the human erythrocyte. He investigated biological free radical reactions-reactions of the superoxide anion (O_2^-) and the enzyme superoxide dismutase. He performed experimental work on both *in vitro* and *in vivo* systems.

1971: Assistant Quality Control Chemist, Benjamin Moore and Company, Newark, New Jersey.

Robert J. Kindya (Continued)

Education

M.S., Environmental Health Sciences, Hunter College (City University of New York), 1976

B.S., Chemistry, City College of New York (City University of New York), 1971

Awards

Winner of a New York State Regents Scholarship
Winner of the George N. Shuster Award of the oustanding Master's thesis in the health sciences at Hunter College for the 1975-1976 academic year

NANCY KRUSELL

Professional Experience

Present Occupation: Environmental Scientist, Health and Environmental Impacts Section, Environmental Planning and Analysis Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Ms. Krusell recently completed an in-depth study for the U. S. EPA to determine the availability, composition, manufacturers, and cost of products that may serve as substitutes for currently marketed asbestos products. Additional work in this area included an asbestos lifecycle report detailing estimated release of asbestos fiber to air, land, and water from product manufacturing, use, and disposal, and a speech on alternatives to asbestos in roofing felt products presented at a July, 1980, EPA Conference in Arlington, Virginia. She has also provided assistance to the U. S. EPA in their efforts to determine State capabilities for Superfund implementation, including in-depth interviews with State personnel. Ms. Krusell has worked on several ground water contamination studies including a project for the Town of Concord and a segment of the Love Canal effort.

She designed a network for monitoring criteria pollutant concentrations in Allegheny County, Pennsylvania, in preparation for future SIP requirements. She also completed public relations/ education and mechanics training aspects of Inspection/Maintenance programs for the States of Ohio, Wisconsin, and Indiana, along with special slide shows and an I/M pamphlet design for Albuquerque, New Mexico. As part of a study to determine the status of operating permits in each U.S. State and territory, Ms. Krusell compiled data in a report that will assist in the development of operating permit regulations by the Federal government.

1977-1978: Arrow Publishing Company, Newton, Massachusetts. Cartographer and co-manager of research department of a map publisher.

1976: Old Colony Planning Council (OCPC), Brockton, Massachusetts. Conference Coordinator for "Alternatives to Sewers" Conference sponsored by the EPA and OCPC. In addition, research was completed for The North and South Rivers Watershed Association in Marshfield, Mass., determining ownership of land along the North River in Marshfield for Scenic Rivers Act designation.

Education

B.S., Cum Laude, Environmental Studies, St. Lawrence University, 1976
M.S. Candidate, Water Resources, Northeastern University

Internship Program, St. Lawrence University. Intern with the North and South Rivers Watershed Commission of Marshfield, Massachusetts; the Black River St. Lawrence Regional Planning Board of Canton, New York; and the Environmental Management Council of Potsdam, New York. Also, preparation of Environmental Assessment for Deer Creek, Franklin County, New York, in collaboration with Cornell University, Miner Institute, and the United States Department of Agriculture Soil Conservation Service, 1975

Professional Societies

National Water Well Association

NANCY KRUSELL

Publications

Krusell, N. and D. R. Cogley. Asbestos Substitute Performance Analysis. May 1981. Final Report, EPA Contract Number 68-02-3168. Service Area 3, Work Assignment Nos. 7 and 18.

Cogley, D., N. Krusell., et al. Life Cycle of Asbestos in Commercial and Industrial Use Including Estimates of Releases to Air, Water and Land. January 1981. Draft Final Report, EPA Contract Number 68-02-3168 and 68-02-2706.

Bartlett, P., N. Collins, E. Mussler, and N. Krusell. Survey of Selected State Capability to Perform Tasks Mandated by Superfund. February 1981. Final Report, EPA Contract Number 68-02-3168. Technical Service Area 3, Work Assignment No. 27.

Krusell, N., Frech, Kizenko. Design of a Comprehensive Plan for Allegheny County, Pennsylvania, Air Quality Monitoring Network. May 1979. Draft Final Report. EPA Contract Number 68-02-2607, Work Assignment No. 26.

Vlasak, D., N. Krusell, et al. Evaluation of Motor Vehicle Emissions Inspection and Maintenance Programs for Indiana. October 1978. Final Report, prepared for the Indiana State Board of Health, Air Pollution Control Division.

ARLENE LEVIN

Professional Experience

Present Occupation: Environmental Scientist, Environmental Planning and Analysis Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Ms. Levin provides planning and analysis support for both health effects and environmental management studies with emphasis on hazardous and toxic substances. Ms. Levin is currently task manager of a project to supply the U.S. EPA with enforcement support for future asbestos reporting regulations. She is compiling and evaluating health effects data for hazardous pollutants in air and water for two projects. Ms. Levin was an investigator in preparing a long-term waste management plan for the State of Illinois. This project involved defining waste types generated by industry in Illinois and identifying applicable management alternatives and technologies/processes. She organized a U.S. EPA workshop on asbestos substitutes and is currently preparing and editing the proceedings from the workshop. Past projects have included providing technical support to the U.S. EPA in the prosecution of hazardous waste enforcement cases and preparing background material on polychlorinated biphenyl marking and disposal regulations.

1979: Science Intern, Massachusetts Department of the Attorney General, Environmental Protection Division, Boston, Massachusetts. Ms. Levin compiled, interpreted, and presented technical material necessary for the investigation and prosecution of cases involving solid waste, hazardous waste, septic systems, and wetlands. In addition, Ms. Levin prepared a paper for the Environmental Protection Division making recommendations to expedite solid waste cases. This study involved an investigation of landfills and resource recovery facilities in the State.

1976-1978: Medical Technologist, Peter Bent Brigham Hospital, Microbiology Laboratory, Boston, Massachusetts. Ms. Levin's responsibilities included the isolation of bacteria, fungi, and parasites; performing serological tests; and teaching undergraduate students laboratory techniques. Also, Ms. Levin conducted and taught a special cryptococcal agglutination test.

1976: Internship Program, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania. Ms. Levin performed clinincal rotations through Hematology, Blood Banking, Chemistry, Endocrinology, Urinalysis, Serology, Bacteriology, Parasitology, and Phlebotomies.

1974: Laboratory Assistant, Veterinarian School, University of Pennsylvania, Philadelphia, Pennsylvania. Ms. Levin assisted in biochemistry research of urokinase isolation and activity.

Education

M.P.H., Environmental Science, Columbia University School of Public Health, 1980

Arlene Levin (Continued)

B.S., Medical Technology, University of Pennsylvania, 1976
B.A., Biology, University of Pennsylvania, 1976
Special Student, Environmental Health Science, Harvard University School of Public Health, 1979-1980

Certification

M.T., American Society of Clinical Pathologists

Professional Societies

American Association for the Advancement of Science
American Public Health Association
American Society of Clinical Pathologists
Massachusetts Public Health Association

ROBERT BOWLEY LUCAS

Professional Experience

Present Occupation: Senior Environmental Engineer, GCA/Technology Division, GCA Corporation, Chapel Hill, North Carolina. Recent projects that Mr. Lucas has been responsible for and contributed to have included the follwing: an engineering cost anaysis of the capital investment and annualized costs of an integrated petroleum refinery and the associated pollution control equipment; an examination of treatability and discharge severities for wastewater effluent from a coal liquefaction plant; an assessment of cadmium emissions for the secondary nonferrous smelter industry; and a determination of fugitive emissions and discharge severities for the storage vessels associated with a shale oil refinery.

1979-1980: Environmental Engineer, F. T. Green Associates, Wilson, North Carolina. Mr. Lucas was responsible for preparing wastewater treatment facility plans for four small communities in eastern North Carolina. His duties included preliminary engineering design, cost and energy comparisons, environmental impact analyses, and sewer system studies. Plans emphasized innovative land treatment technologies including spray irrigation and rapid-infiltration. Additional projects included the preparation of an environmental assessment for a neighborhood redevelopment project and the design of a solid-set spray irrigation system for a vegetable cannery.

1975-1979: Environmental Engineer, Wisconsin Department of Natural Resources, Green Bay, Wisconsin. Mr. Lucas coordinated activities of a three-man team directed at improving operation and maintenance procedures at wastewater treatment plants. He worked with facilities ranging from 50,000 gallons per day to 30 million gallons per day. Routine duties included the following: conducting sampling surveys and troubleshooting inspections; reviewing plant and laboratory procedures and records; developing and presenting training courses; reviewing plant design criteria; and preparing written reports.

Before assuming these responsibilities, Mr. Lucas was a district engineer with responsibility for municipal and industrial wastewater treatment facilities in three counties. His routine responsibilities included conducting compliance sampling inspections, initiating enforcement actions against permit violators, reviewing plans and specifications for proposed facilities, and investigating public complaints. Mr. Lucas' additional duties included lecturing at operator training school, reviewing planning documents, sewer studies, and operation manuals, and making presentations to community and citizen groups.

Robert Bowley Lucas (Continued)

Education

B.S.E., Biomedical Engineering, Duke University, 1974

Honors

National Merit Scholarship

Licenses

North Carolina Water Plant Operator, Grade B

Professional Societies

Water Pollution Control Federation/North Carolina
Water Pollution Control Association

KENNETH T. McGREGOR

Professional Experience

Present Occupation: Group Scientist and Manager of the Laboratory Analysis Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Dr. McGregor is responsible for the operation of GCA's inorganic and organic analytical laboratories and for the quality assurance program required by the laboratory.

Dr. McGregor recently supervised the work of 11 analytical laboratory subcontractors to GCA on the EPA-funded multimedia environmental monitoring program at Love Canal, Niagara Falls, New York. He monitored technical, budget, and schedule performance and conducted onsite audits as part of GCA's quality assurance program for this study.

Dr. McGregor has supervised the development, evaluation, and performance of several EPA-sponsored environmental analysis programs. He is currently the program manager for an EPA contract for the Development, Evaluation and Field Testing of Inorganic Measurement Methods for Environmental Assessment Programs. He is also the Laboratory Manager for an EPA contract for the Environmental Assessment of the Fluidized-Bed Combustion Process and an EPA subcontractor to measure emissions from conventional combustion systems.

Previously, Dr. McGregor served as the laboratory task manager for the Massachusetts Total Suspended Particulate Program. He has also served as the program manager of several industry-sponsored method development and material characterization programs. He has, in addition, used a wide variety of instrumental methods including spark source mass spectrography, atomic absorption spectrometry, X-ray diffractometry, X-ray photoelectron spectroscopy, or ESCA, and ion chromatography to analyze a variety of source and ambient environmental pollutant samples for inorganic composition.

1975-1977: Research Associate in Chemistry, Princeton University, Princeton, New Jersey. Dr. McGregor performed material science and basic research on metal ion systems using NMR, EPR, X-ray diffraction, and atomic absorption.

1973-1975: Research Assistant in Chemistry, University of North Carolina, Chapel Hill, North Carolina. Dr. McGregor conducted research into electronic structure of inorganic materials in which metal ions play a central role.

Kenneth T. McGregor (Continued)

1971-1973: Teaching Assistant in Chemistry, University of North Carolina, Chapel Hill, North Carolina. Dr. McGregor instructed laboratory courses in general and inorganic chemistry and gave lectures in inorganic chemistry courses.

Education

Ph.D., Inorganic Chemistry, University of North Carolina, Chapel Hill, North Carolina, 1975
M.A., Inorganic and Analytical Chemistry, University of North Carolina, Chapel Hill, North Carolina, 1972
B.S., Chemistry and Mathematics, Austin Peay State University, Clarksville, Tennessee, 1971

Professional Societies

American Chemical Society
American Association for the Advancement of Science

Publications

Over 20 publications in analytical and inorganic chemistry

EDWARD F. MUSSLER

Professional Experience

Present Occupation: Environmental Engineer, Environmental Engineering Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Mr. Mussler was a principal investigator on a project for the EPA to assess State capabilities to respond to and deal with hazardous waste sites and emergency spills. The project involved analyzing and interpreting proposed congressional bills with respect to the needs of a state to respond to hazardous waste emergencies. To assess these needs, Mr. Mussler collaborated in preparing a detailed questionnaire, which was used to conduct a field survey. The questionnaire responses were then collated and analyzed for a final report to EPA. Mr. Mussler was also involved in a project to research and prepare a report for the State of Illinois regarding industrial waste treatment and disposal. He prepared the study on land disposal of industrial and hazardous wastes, including incorporating the new RCRA hazardous waste standards into current engineering and legislative practice.

Mr. Mussler has conducted facility inspections throughout U.S. EPA Region V to determine the adequacy of State level enforcement efforts in achieving and maintaining compliance with all applicable SIP requirements. These inspections involved the evaluation of control equipment performance, assessment of visible emissions, and preparation of industrial survey reports.

Mr. Mussler has contributed to many of GCA's projects on asbestos. He has researched product alternatives to asbestos for inclusion in a document on feasibility and performance of asbestos substitutes for EPA's Office of Toxic Substances. The safe testing of several asbestos-containing products, including data analysis and test development, and onsite monitoring of fibers has been accomplished.

Mr. Mussler was also an authorized representative of the U.S. EPA conducting inspections of asbestos manufacturing and fabricating facilities and disposal operations in Region V. His reponsibilities included contacting plant personnel, collecting samples and data sufficient to determine compliance with the NESHAP standards, and writing a final inspection report.

Mr. Mussler developed a calibration curve for GCA's Coal Mine Dust Incombustibles Content Meter for the U.S. Bureau of Mines. In this project, a comprehensive test program was developed and implemented.

Education

B.S., Environmental Engineering, Rensselaer Polytechnic Institute, Troy, New York, 1979

EDWARD F. MUSSLER

Publications

Chillingworth, M. A., T. J. Nunno, A. Levin, P. M. Brown, E. F. Mussler. Industrial Waste Management Alternatives and Their Associated Technologies/Processes. Prepared for Illinois Environmental Protection Agency, Division of Land Pollution Control, GCA/Technology Division, GCA-TR-80-80-G, September 1980.

BARBARA M. MYATT

Professional Experience

Present Occupation: Environmental Scientist, Laboratory Analysis Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Ms. Myatt is currently involved in several projects designed to evaluate sampling and analysis techniqes used in Environmental Assessment programs. Her responsibilities include conducting background research on collection techniques for volatile trace metals, the current uses and potential applications of ion chromatography, and the effect of ammonia on the sampling and analysis of sulfur oxides and nitrogen oxides. Ms. Myatt has also participated in designing experimental programs to further investigate these and similar topics. In addition, she frequently conducts evaluations of standard and modified measurement methods, including continuous monitors, for applicability to specific stationary source effluents. In a related program, Ms. Myatt served as task manager and principal investigator, compiling an annotated bibliography of literature on inorganic measurements for environmental assessments and developing a procedures assessment protocol for evaluating such techniques.

Ms. Myatt recently served as liaison for laboratory analysis and QA/QC activities in the Love Canal Study. In this capacity, she assembled the analytical and quality control procedures used in subcontracts and the project QA manual. She is familiar with all facets of the analytical program used in that study and frequently contacted subcontractors to clarify procedures and monitor progress.

Ms. Myatt has previously participated in the design and construction of a sample stream generator to simulate flue gases of varied chemical composition, temperature, and flow rate. She has also served as a principal investigator in a program to characterize total suspended particulates (TSP) for total volatiles and selected anions and metals. In this capacity, she assisted in the development of an ashing-fusion technique to prepare cellulose filter samples for analysis of silicon by atomic absorption.

Ms. Myatt is experienced in trace element and inorganic compounds analysis in particulate and liquid samples. Techniques that she has used regularly include atomic absorption spectroscopy (AA), ion chromatography (IC), and various wet chemical methods. In addition, Ms. Myatt has developed sample handling and analytical procedures used in the analysis of environmental samples by X-ray photoelectron spectroscopy (ESCA). She has also used EPA Methods and Level I and Level II procedures.

Barbara M. Myatt (Continued)

1975-1976: Harvard Lake Study. Ms. Myatt was responsible for nutrient analysis of water samples for a limnological study using EPA Methods.

Education

A.B., Engineering and Applied Physics, Concentration in Environmental Sciences, Harvard University, 1976

THOMAS J. NUNNO

Professional Experience

Present Occupation: Senior Environmental Engineer, Environmental Engineering Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Mr. Nunno was principal investigator on a study of industrial waste management alternatives for the State of Illinois. Nine waste management alternatives were evaluated including land disposal, deepwell injection, source reduction, and recovery/reuse. He investigated 29 industrial waste treatment technologies including physical, chemical, and biological processes designed to handle organic and inorganic liquid wastes and sludge residuals.

Mr. Nunno currently manages a program evaluating performance of 50 municipal wastewater treatment facilities in EPA Region VIII. He is identifying facilities requiring remedial action, supervising field evaluations, recommending design and operational modifications, and monitoring the effect of corrective measures.

Also at GCA, Mr. Nunno has evaluated air pollution control systems at 13 iron and steel mills in the United States and Canada. Sources investigated include sintering plants, BOF shops, EAF shops, coke plants, and blast furnace casthouses.

1977-1979: Environmental Engineer, Fay, Spofford and Thorndike, Inc., Boston, Massachusetts. Mr. Nunno coordinated efforts of a joint venture between FS&T and F. N. Zaino, Inc., to evaluate wastewater systems for Cranston, Rhode Island. He designed and conducted a field data collection program and cost analysis of alternatives, and prepared a final report. He also analyzed the industrial contribution of toxic heavy metals to the South Portland WWTP to predict metal content of composted sludge. He also prepared WWTP facility plans, preliminary designs for wastewater land application facilities, community waste disposal systems, and sludge composting facilities.

In addition, Mr. Nunno participated in a major infiltration/inflow analysis of the South Metropolitan Sewerage District (Boston), and supervised computer input and analysis of data from 65 continuous monitoring stations, as well as prepared portions of the final report.

Education

M.S., Environmental Engineering, University of Massachusetts, 1978
B.S., Civil Engineering, University of Massachusetts, 1975

Thomas J. Nunno (Continued)

Honors

Received 1979 ASCE Wesley W. Horner Award for significant contribution in the field of environmental engineering

Professional and Honor Societies

American Society of Civil Engineers
New England Water Pollution Control Federation
Tau Beta Pi, Massachusetts Chapter

LESTER Y. PILCHER

Professional Experience

Present Occupation: Staff Environmental Engineer, GCA/Technology Division, GCA Corporation, Chapel Hill, North Carolina. Mr. Pilcher has been directing efforts to develop background information for air pollution emissions regulations for fertilizer manufacturing industries. This work involves process engineering, evaluation of air pollution control equipment, cost analysis, and investigation of regulatory alternatives. Mr. Pilcher is also involved in assessing the suitability, cost relationships, and potential health effects of asbestos substitutes.

1976-1979: Chief Technical Support Branch, U.S. Army Environmental Hygiene Agency, Aberdeen Proving Ground, Maryland. In this position, Mr. Pilcher supervised ten engineering technicians, physical science technicians, and chemists in support of ambient and source sampling surveys at Army installations. Mr. Pilcher planned, organized, and performed source sampling surveys and provided consultation to Army installations on pollution standards and regulations, compliance status of sources, review of pollution control equipment designs, and control equipment required for compliance. He also provided consultation to Army installations on permit requirments, Clean Air Act requirements, and reviewed installation EIA/EISs. Mr. Pilcher represented the Army and Army installations at meetings with EPA and State regulatory agencies and was a member of the Corps of Engineers' selection board for selecting contractors to perform environmental monitoring in support of the Army pollution abatement program. One of Mr. Pilcher's functions was observing contractors performing source sampling at Army sources and preparing observation reports. For these observations, he prepared a Guideline Document for Observing Source Sampling Surveys, portions of which have been used by EPA personnel.

1972-1976: Project Officer, 10th Medical Laboratory, Division of Environmental Health Engineering, Landstuhl, Germany. Mr. Pilcher planned, organized, and performed environmental monitoring surveys in air pollution, water pollution, and industrial hygiene for Army installations in Europe. There, surveys determined compliance with host nation environmental standards and identified potential environmental health problems. While in Germany, he prepared disposal plans for hospital hazardous wastes. He performed both domestic sewage treatment plant evaluations and sampled and evaluated wastewater effluents from industrial operations. His assignment for the Army in Germany included 2 years' work as an industrial hygienist, evaluating occupational health hazards, including evaluations of worker exposure to hazardous materials, and recommending engineering controls and personal protective equipment to meet OSHA standards. Mr. Pilcher participated in several

environmental noise surveys in which the noise impact of Army aircraft on German communities was evaluated. A major accomplshment of Mr. Pilcher's was to set up an air pollution source sampling program for the Army in Europe in which he ordered all equipment, trained all personnel, and planned and performed a program to determine the compliance of air pollution standards with host country environmental air pollution standards.

1971-1972: Staff Sanitary Engineer, Office of the Surgeon, HQ, 8th U.S. Army, Seoul, Korea. Mr. Pilcher, while serving as staff sanitary engineer for the Headquarters, 8th U.S. Army, was responsible for planning and directing enviromental sanitation support to U.S. Forces in Korea. These responsibilities included evaluating command environmental health standards, writing regulations, and providing consultation on environmental health and pollution to staff elements of HQ's 8th U.S. Army, Korea.

Education

M.S., Environmental Systems Engineering, Clemson University, 1970
B.S., Chemistry, Clemson University, 1969
Several EPA- and Army-sponsored courses in air pollution control and sampling

Honors

Awarded Army Commendation Medal for outstanding performance of duties while assigned as Staff Sanitary Engineer, Office of the Surgeon, HQ's, 8th U.S. Army, 1972
Awarded Army Commendation Medal for outstanding performance of duties while assigned as Project Officer, 10th Medical Laboratory, Landstuhl, Germany, 1976
Awarded Army Meritorious Service Medal for meritorious service while assigned as Chief, Technical Support Branch, U.S. Army Environmental Hygiene Agency, Aberdeen Proving Ground, Maryland, 1979

Publications

Author of numerous technical reports on air pollution source surveys, wastewater surveys, and industrial hygiene surveys

LESTER Y. PILCHER

Publications

Guidelines of Observing Source Sampling Surveys, U.S. Army Environmental Hygiene Agency, 1979.

Summary of U.S. Army Source Sampling Surveys, U.S. Army Environmental Hygiene Agency, 1978.

DOUGLAS R. ROECK

Professional Experience

Present Occupation: Senior Environmental Engineer, Environmental Engineering Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Mr. Roeck has been Project Manager in the following recent program areas: plant startup procedures in 27 source categories subject to NSPS; a nationwide assessment of particulate emission sources, compositions, and trends; an investigation of regulatory control options concerning the chemical acrylamide; and an evaluation of the use of fluidized-bed combustion as a means of incinerating hazardous wastes. Additionally, he was the Principal Investigator for a technology assessment report concerning particulate control of industrial-sized boilers and a Capsule Report for EPA documenting the application of fabric filtration to these same size combustion units. Mr. Roeck has also been involved in data assimilation for the sulfate regional experiment (SURE) conducted for EPRI, source inspections in Regions I and II, utility compliance schedule evaluations, and work relating simultaneous opacity and mass emissions measurements.

1973-1977: Air Pollution Engineer, Department of Environmental Quality Engineering, Division of Air and Hazardous Materials, Commonwealth of Massachusetts. Mr. Roeck was responsible for enforcement of air pollution regulations related to combustion and industrial process operations and reviewed control strategies submitted by industry to achieve compliance with applicable emission standards. His field duties included: noise and odor surveys, pollutant sampling, and source inspections at many industries including chemical manufacturing, asphalt batching plants, gray iron foundries, petroleum tank farms, and sources using hydrocarbons and/or hazardous materials. Mr. Roeck also attended numerous seminars, public hearings, and EPA-sponsored courses.

1972-1973: Associate Chemical Engineer, Final Product Testing Laboratory, American Biltrite Rubber Company, Cambridge, Massachusetts. Mr. Roeck was responsible for quality control testing of conveyor belts, fuel line and washing machine hoses, bridge pads, matting, and sports surfaces. Tests included rubber fabric adhesions, stress-strain determinations, load deflections, tensile strength, specific gravity, fadeometer, oxygen bomb, and deterioration by ozone.

1969-1971: Cooperative Education Program, Research Technician, Lever Brothers Research Co., Edgewater, New Jersey. Mr. Roeck performed pilot-plant and laboratory experiments on a new detergent product and worked with drum rollers, soap extruders, and a detergent spray tower. He also assisted on a plant startup in Baltimore, Maryland.

Douglas R. Roeck (Continued)

1967-1969: Cooperative Education Program, Friction Materials Division, the Bendix Corporation, Troy, New York. Mr. Roeck worked with phenol-formaldehyde resins used in both liquid and granular form in the brake lining industry. He became familiar with resin manufacture in the laboratory, in a 50-gallon pilot-plant reactor, and in the 1500-gallon production reactors.

Education

M.S., Environmental Engineering, Northeastern University, 1979
B.S., Chemical Engineering, Northeastern University, 1971

Honors

Northeastern University/EPA Fellowship, 1975-1977
Tau Beta Pi, National Engineering Honor Society

Professional Societies

Air Pollution Control Association

Publications

Mr. Roeck is co-author of 18 reports on topics concerning emisson control technology, combustion systems, and toxic chemical/hazardous waste evaluations.His Masters Report was entitled A Comparison of Active and Passive Approaches to the Utilization of Solar Energy on a Residential Scale.

HOWARD F. SCHIFF

Professional Experience

Present Occupation: Senior Staff Scientist, Environmental Measurements Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Mr. Schiff is a field crew leader for source and ambient sampling. His duties also include special laboratory analyses and quality control. Mr. Schiff has been a project manager or principal investigator on sampling projects in the iron and steel industry such as: efficiency performance testing of a baghouse controlling sinter strand windbox emissions; simultaneous testing of 5 electrostatic precipitators controlling 11 open hearth furnaces; and simultaneous testing of emission control devices on iron ore pelletizing furnaces. He is also principal investigator in GCA's efforts for Regions III and V to define exemplary control technologies within the iron and steel industry. He is also project manager on the continuing U. S. EPA Region I source test observation and technical assistance project.

1972-1977: Air Quality Control Chemist, Gilbert Associates. Mr. Schiff coordinated source sampling with laboratory analytical requirements; developed and updated procedures for sampling and laboratory analysis of pollutants; trained technicians in sampling and analytical procedures; supervised field source sampling and reviewed analytical data; purchased, maintained, and calibrated all sampling equipment and instrumentation; and advised clients on source monitors for all air pollutants.

In the course of performing these programs he sampled for various pollutants including SO_2, SO_3, NO_x, organic solvents and chemicals, particulates, cation and anion composition of particulate matter, particle size analysis by optical and electron microscopy and Bahco analysis, and polycyclic organic material. He supervised field source sampling programs at sources such as: industrial and utility fossil-fuel-fired steam generators (1-1000 MW), paper mills, brass foundries, gray iron cupolas, wood creosoting plants, reverberatory and electric arc furnaces, jet turbines, diesel engines, automotive paint spraying and drying operations, floor covering solvent demister stacks, and automotive dynamometer room vent stacks. In addition, he has performed certification tests on commercial SO_2 and O_2 continuous emission monitoring systems.

1970-1972: Analytical Chemist, Air Sampling Laboratory, Roy F. Weston, Inc. Mr. Schiff developed procedures for sampling and analysis of air pollutants; conducted chemical and physical analyses of pollutants; prepared source sampling and environmental studies reports and proposals; and advised engineers on source sampling.

CHARLES W. YOUNG

Professional Experience

Present Occupation: Section Manager, Combustion/Energy Processes Section, Environmental Engineering Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Mr. Young is currently responsible for a comprehensive program to sample and analyze multimedia emission streams at the Georgetown University fluidized-bed boiler. This work is jointly sponsored by the Environmental Protection Agency and Department of Energy and includes chemical analysis, bioassay, and radioassay of emission streams, continuous monitoring for criteria air pollutants, and analysis of priority pollutants in liquid effluent streams and laboratory-generated leachates from solid waste samples. Workplace monitoring for noise, heat stress, and other applicable factors is also being performed through an interagency agreement between EPA and the National Institute of Occupational Safety and Health.

Mr. Young was task manager for a technical/economic assessment of fluidized-bed combustion as part of EPA's background investigation of alternative control techniques for industrial boilers. The scope of work included assessment of emission control capability and determination of associated economic, energy, and environmental impact. Sensitivity analyses were performed to pinpoint the most influential parameters. He was also task manager for an assessment of arsenic emissions from U.S. primary copper smelters. In additon, he performed an engineering analysis and environmental assessment of the coal-fired chemically active fluid-bed process and a conventional secondary aluminum smelter.

1976: Environmental Engineer, SEA Consultants, Inc., Boston, Massachusetts. Mr. Young prepared facilities planning reports for wastewater treatment and collection projects, including a detailed study of alternative methods, environmental impact, and system cost effectiveness. He also reviewed engineering reports before final submittal to client. Technical areas included wastewater collection and treatment, infiltration/inflow, water supply and distribution, solid waste disposal, and environmental impact.

1975: Environmental Engineer, Environmental Engineering Department, GCA/Technology Division, GCA Corporation, Bedford, Massachusetts. Mr. Young performed environmental assessments of water and solid waste discharges associated with alternative energy systems. Projects included assessment of conventional stationary combustion sources and the residual oil-fired chemically active fluid-bed process.

Charles Young (Continued)

1968-1974: Environmental Engineer, Metcalf and Eddy, Inc., Boston, Massachusetts, full time employment (2 years), preceded by cooperative employment assignment. Mr. Young was responsible for wastewater treatment plant design, sewerage design, community planning, infiltration/inflow analysis, ambient water monitoring, construction supervision, technical report writing, specification writing, cost estimation, and CPM development. He participated in design of large (300-400 mgd) wastewater treatment facilities and conducted ambient water monitoring for a regional wastewater management study and a large food processing industry.

Education

M.S., Environmental Health Sciences, Harvard School of Public Health, 1976
B.S., Civil Engineering, Northeastern University, 1972

Honors

Traineeship, Harvard School of Public Health, 1974-1976
Tau Beta Pi, National Engineering Honor Society

Professional Societies

Air Pollution Control Association